Knappen-Tippetts-Abbett-McCarthy, engineers,
New York.

PRELIMINARY REPORT

on

ECONOMIC AND ENGINEERING SURVEY OF BURMA

for

Burma Economic Council

JANUARY 1952

KNAPPEN TIPPETTS ABBETT ENGINEERING CO.

Associated with

PIERCE MANAGEMENT, INC.

and

ROBERT R. NATHAN ASSOCIATES, INC.

23578

FOREWORD

AUTHORITY: This Preliminary Report is being submitted to the Government of the Union of Burma as partial fulfillment of the contract dated August 8, 1951, between the Government of the Union of Burma and Knappen Tippetts Abbett Engineering Company of New York City. As provided in the contract the Knappen Tippetts Abbett Engineering Company has associated itself with Pierce Management, Inc., of Scranton, Pennsylvania, Coal and Metal Mining Engineers, and Robert R. Nathan Associates, Inc., Washington, D. C., Economists. The dollar costs under this contract are being paid by the Economic Cooperation Administration of the United States.

Article I, Section C, sub-section 1a of the contract provides that a written report of the Government of the Union of Burma based on a general preliminary survey of the national economy of Burma be submitted "within approximately twenty weeks" from the date of the signing of the contract. By written mutual agreement the submittal date was established as January 31, 1952. This Report is now presented in fulfillment of that requirement.

SCOPE: The responsibilities of Knappen Tippetts Abbett Engineering Company and its associates under the contract fall into six categories:

1. Surveys and Reports
   a. Preliminary Survey and Report
   b. Project Surveys and Reports
   c. Comprehensive Report
2. Preparation of Applications for Financing
3. Services Relative to Specific Projects
4. Continuous Engineering, Consulting and Economic Advisory Services
5. Purchasing Services
6. Training of Burmese Technicians

Under 1c above Knappen Tippetts Abbett Engineering Company will provide a written report at or before the end of the contract period, outlining a comprehensive and integrated program for the overall development of the resources of Burma and the Governmental and private measures designed to place such a program into operation. This Preliminary Report is not intended to fufill the requirements of the final Comprehensive Report. Rather it reports on the initial survey of the resources and national economy of Burma, indicates the main features of an overall economic development program, and makes recommendations with respect to projects and policies which appear feasible and desirable on the basis of the initial survey. It also indicates the nature of the work to be performed during the remaining term of the contract of more than eighteen months.

This Preliminary Report, in accordance with the nature and the terms of the contract, is comprehensive in coverage but limited in the degree to which the various aspects treated could be explored. The first limiting factor was time. Principals of the firms and the first personnel arrived in Burma on September 1, 1951. The remaining staff members were selected carefully after the appraisal of the survey and program by the principals. During the following three months most of the consultants and staff members came to Burma. The six consultants have been in Burma for an average of 15 weeks and the fifteen field staff members of professional or technical level have been here for an average of 10 weeks. Further, the data available on the economy of Burma are inadequate and it has not been possible to develop quantitative or qualitative information in satisfactory degree. In addition to a survey of information available in Rangoon, there has been some limited study outside Rangoon; but accessibility to many geographical areas in Burma where resources must be surveyed intensively and on the site has been limited. It was necessary to place major reliance on secondary sources of information. Considerable work

has been done in the United States in the way of assembling information. The home office personnel of the three organizations have provided a back-stop for the field staff at work in Burma.

Because of the shortage of time and insufficient primary information, it has not been possible to achieve the degree of precision or balance in the proposed program which it is hoped will characterize the Final Report. Some fields have been explored more fully than others. Likewise these limitations have prevented the establishment of a final order of priorities for projects and final judgments concerning policies. However, the recommendations which are included in this Report are put forward with reasonable assurance as to their benefit to the Government and the people of Burma. Projects and policy areas which are treated less fully here will receive thorough study and investigation before the submission of the Comprehensive Report.

ORGANIZATION: The following principals have visited Burma to initiate the survey, furnish consulting and advisory services during its course, assist in the preparation of the Preliminary Report and make the official presentation to the Government:

Ernest F. Tippetts, Partner, Knappen Tippetts Abbett Engineering Co.
Robert W. Abbett, Partner, Knappen Tippetts Abbett Engineering Co.
Gerald T. McCarthy, Partner, Knappen Tippetts Abbett Engineering Co.
James H. Pierce, Chairman, Pierce Management Company, Inc.
John S. Marshall, President, Pierce Management Company, Inc.
Robert R. Nathan, President, Robert R. Nathan Associates, Inc.

The General Manager of the survey is Homer B. Pettit, and the Deputy General Manager and Chief Engineer is John B. Alexander.

The following consultants have spent a total of many months in Burma on the survey:

Economist—Louis J. Walinsky
Economic Geologist—Stuart St. Clair
Mining Engineer—Evan Bennett
Transportation, Ports and Waterways—Francis B. Wilby
Transportation Engineer, Railways, Highways, Airways and Communications—Ewart G. Plank
Hydro-Electric Engineer—Frank P. Fifer

Staff Members:

Frank D. Ahern, Construction Engineer
B. A. Blanchard, Management Administrator
J. B. Chadwell, Office Manager
Everett E. Hagen, Industrial Economist
Sam Hancock, Mining Engineer
K. A. Lambert, Mining Engineer
Jack W. Ninneman, Aerial Survey Engineer
Henry R. Norman, Transportation Engineer, Ports & Waterways
Arthur R. Reitter, General Civil Engineer
Alfred A. Strauss, Industrial Engineer
William W. Tamplin, Economic Geologist
George M. Tapley, Hydro-Electric Engineer
Peter N. Vukasin, Economic Analyst

ACKNOWLEDGEMENTS: All of the Ministries, Departments and Boards of the Government of the Union of Burma from whom information and other help has been sought have been most cooperative in every possible way. The personnel of the Special Technical and Economic Mission of the Mutual Security Administration in Rangoon has been helpful. Special appreciation should be expressed to U Hla Maung, Secretary of the Ministry of National Planning, and his staff. It is impossible to give credit to everyone who has been of help to the survey group but among them the following persons have been particularly cooperative:

Ministry of National Planning: U Hla Maung, Secretary; Mr. J. S. Furnivall, Planning Adviser; Dr. Philip Hauser, Statistical Adviser; U. Kyaw Khine, Commissioner of Census; Dr. A. N. Ghosh, Director of Metallurgical Research Dept.; Mr. R. C. Barber, Officer on Special Duty; Mr. F. S. Smith, Additional Deputy Secretary; U Chein Hai, Distribution Officer, BECA; U Thet Tun, Research Officer; U Tun, Public Relations Officer; Daw San Shin, Junior Economic Officer; U Hla Htaw, Junior Economic Officer; Daw Tin Tin, Librarian.

Ministry of Judicial Affairs: Mr. M. A. Raschid, Chairman, Court of Industrial Arbitration.

Ministry of Foreign Affairs: U Ba Saing, Controller of Immigration.

Ministry of Agriculture and Forests: Mr. C. Kyaw Khine, Chief Conservator of Forests; Mr. C. Kwet Kaw, Forest Economist; U. Hman, Chairman, State Timber Board; Mr. L. J. McLean, Chief Engineer, Irrigation Dept.; Mr. Robert Maung Tin, Superintending Engineer, Irrigation Dept.; Mr. A. C. Monro, Superintending Engineer, Irrigation Dept.; U Khin, Director of Agriculture; U Ba Tin, Assistant Director of Agriculture; U Soe Tint, Registrar, Cooperative Societies.

Kayah State: The Hon. Sao Wunna, Minister; Mr. Raphael Peter Thaung, Secretary; U Kyaw Pe, Assistant Engineer.

Ministry of Public Works and Labor: U Ba Maung Chain, Chief Engineer, Buildings and Roads Dept.; U Maung Maung Gyi, Personal Assistant to Chief Engineer,

Buildings and Roads Dept.; U On Nyun, Superintending Engineer, Tenasserim Circle; U Hla Maung, Superintending Engineer, Maritime Circle; Mr. T. D. Boldy, Superintending Engineer, Electrical and Mechanical Circle; Mr. R. E. B. Rivers, Superintending Engineer, Pegu Circle; U Tha Dok, Superintending Engineer, Prome Circle; U Aung Tun, Superintending Engineer, Mandalay Circle; U Kyi Mun, Executive Engineer, Amherst Division; U Thet Tun, Executive Engineer, Mandalay Division; U Win Maung, Mechanical Engineer, Electrical and Mechanical Circle; U Ba Han, Sub-Divisional Officer, Buildings and Roads Dept.; U Khint Maung, Director of Labor; U Sein, Labor Commissioner; Mr. J. C. Koop, Statistical Officer, Directorate of Labor; U Thein Tin, Manager, Government Employment Exchange; U Sein, Chief Inspector of Factories.

Ministry of Home Affairs: U Kyaw Myint, Commissioner of Police, Rangoon; U Ba Than, Superintendent of Police, Motor Vehicle Dept.

Ministry of Finance and Revenue: Mr. B. K. Bose, Additional Secretary, Ministry; U San Maung, Special Savings Officer, Ministry; U Ba Khin, Accountant-General; U Mya Maung, Deputy Accountant General; U San Lin, General Manager, Union Bank of Burma; Mr. Paul Fitchen, Adviser, Union Bank of Burma; Mr. Theodore Sumberg, Chief Economist, Union Bank of Burma; U Khin Maung Gyi, Deputy Controller of Foreign Exchange; U Maung Maung Hla, Economist, Union Bank of Burma; U Hla, Overseer of Presses, Survey Dept.; Mr. F. K. Kar, Officer on Special Duty, Survey Dept.; U Aung Myint, Appraiser, Burma Customs.

Ministry of Information: Mr. J. I. D. Vauz, Deputy Superintendent, Government Press.

Ministry of Industries and Mines: U Pu, Mining Advisor; Dr. Ba Thi, Acting Director, Geological Dept.; W. Pitt Hyde, Consultant to the Ministry of Mines; U Min Din, Geologist, Geological Dept.; Dr. Kyaw Mying, Geologist, Geological Dept.; U. Saw Tun, Deputy Director of Industries; U Tun Thein, Superintendent of Cottage Industries; U. Khin Pe, Officer on Special Duty, Tile Factory Board; U Tun Ohn, Chief Engineer, Hydro-Electric Survey Board; U Maung Aye, Hydro-Electric Engineer; U Kyi Khin, Assistant Hydro-Electric Engineer.

Ministry of Transport and Communication: The Hon. Mahn Win Maung, Minister, Transport and Communication; U Shwe Mra, Secretary, Ministry of Transport and Communication; U San Ni, Chief Executive Officer, Road Transport Department; Sithu Saw Butler, Deputy Secretary, Ministry of Transport and Communication; U Khin Maung Gyi, Assistant Secretary, Ministry of Transport and Communication; T. P. Verma, Assistant Secretary, Ministry of Transport and Communication; Group Capt. P. Holryod Smith, O.B.E., R.A.F.O., Former Director of Civil Aviation.

Ports-Waterways—Mr. S. C. Liu, General Manager, Inland Water Transport Board; U Ba Bwa, Deputy General Manager, Inland Water Transport Board; U Kyaw Din, Marine Superintendent, Inland Water Transport Board; Mr. J. C. Needham, Nautical Advisor, Ports and Waterways; Mr. C. W. Hancock, Nautical Surveyor, Ports and Waterways; U Kyaw Tha, Chairman, Commissioners for the Port of Rangoon; Mr. B. B. Crabbe, Chief Engineer, Commissioners for the Port of Rangoon; Mr. R. I. Warwick, Deputy Chief Engineer, Commissioners for the Port of Rangoon; Mr. W. H. M. Todd, Traffic Manager, Commissioners for the Port of Rangoon; Mr. A. L. Instance, Master Attendant, Commissioners for the Port of Rangoon; Mr. S. W. Spencer, Port Officer, Akyab; Mr. G. H. Waugh, Port Officer, Bassein; Mr. D. S. Harding Raines, Port Officer, Moulmein; U Maung Gyi Aung, Port Officer, Mergui.

Railways—Mr. E. Barnard, Chairman, Union of Burma Railway Board; U Tun Thwin, General Manager; U Sett Kaing, Secretary to General Manager; U Kyi Win, Chief Engineer; U Maung Maung, Deputy Traffic Manager (Commercial); U Than Tin, Controller of Railway Accounts; U Thein Nyun, Deputy Controller of Railway Accounts; Saw MacCarthy Gyaw, Statistical Officer; U Shwe Shane, Deputy Civil Engineer; U Hla, Deputy Chief Mechanical Engineer (Locomotive); Mr. G. E. C. Peters, Deputy Chief Mechanical Engineer, Myitnge Carriage Works; Mr. W. H. Bartholomew, District Engineer, Mandalay; Mr. T. Sattanathan, Statistical Officer.

Airways—U San Thein, Chairman, Union of Burma Airways Board; Sithu Saw Butler, Member of the Board; U Taw, Secretary and General Manager, Union of Burma Airways; U Kyaw Tha, Technical Manager, Union of Burma Airways; U Min Swe, Commercial Manager, Union of Burma Airways; U Maung Gyi, Statistical Officer, Union of Burma Airways; Capt. R. P. Tissandier, Chief Pilot and Operations Manager, Union of Burma Airways; U Kyaw Tun, Acting Director of Civil Aviation; Mr. Cardoza, Aerodrome Officer, Mandalay; U Ba Thet, Airstrip Superintendent, Myitkyina; U Pe Tin, Airstrip Superintendent, Moulmein; Group Captain P. Holroyd Smith, O.B.E., R.A.F.O., ex-Director of Civil Aviation; Mr. E. A. Moultrie, Chief Aerodrome Officer; U Pe Tint, Chief Traffic Officer.

Telecommunications—U Ba Choe, Director, Telecommunications Department; U Thaung, Sub-divisional Officer, Mandalay (Telecommunications Department).

Ministry of Education and Local Government: U Ba Sein, Secretary, Ministry of Education.

Ministry of Public Health Departments: Dr. Maung Gale, Director, Department of Medical and Health Serv-

ices; Dr. Tha Gyaw, Deputy Director, Department of Medical and Health Services.

American Embassy, STEM, WHO, FAO: Mr. Robert B. Shaw, Vice Consul, American Embassy; Mr. James H. Boulware, Agricultural Attache, American Embassy; Mr. James Ward, Labor Officer, American Embassy; Mr. Richard Morse, Assistant to Director, STEM; Mr. William J. Green, Agriculture Officer, STEM; Mr. Isom Deshotels, Assistant Agricultural Officer, STEM; Mr. J. T. Sanders, Land Classification Adviser, STEM; Mr. Roger Thorpe, Economic Officer, STEM; Mr. Ralph K. Eyster, Program Operations Officer, STEM; Dr. Leroy R. Allen, Public Health Officer, STEM; Dr. George Adams, Professor of Pathology, STEM; Dr. J. A. von Monroy, Integrated Forestry Expert, FAO; Mr. George L. Reed, Housing Consultant, National Housing Board.

Others: Thakin Chit Tin, Executive Committee Member of the Union of Burma Chamber of Commerce and Industry; H. Sein Lwin, Chief Chemical Engineer, The National Store; U Lay Myint, Manager, Civil Supplies Transport Union; Mr. R. C. Leach, Burma Corporation, Ltd., General Manager, Rangoon; Mr. E. H. Tregoning, Burma Corporation, Ltd., General Manager, Namtu; Mr. G. Brown-Douglas, Burma Corporation, Ltd., Mine Superintendent; Mr. R. M. Aldworth, Mining Operator, Taunggyi; Mr. E. G. Beresford, Electrical Engineer, General Electric Company of Burma; Mr. Horace Hartley, General Electric Company of Burma; Mr. V. M. White, Electrical Engineer, Westinghouse Trading Company, Bombay, India; Mr. H. T. Woody, Chief Engineer, Electric Tramway and Supply, Rangoon; Mr. E. Lyngbeck, Director, Christiani and Nielsen (Thai), Ltd., Mingaladon Airport Construction; Mr. G. J. Hancock, Director, Arakan Flotilla Company.

SUMMARY OF PRELIMINARY REPORT

SUMMARY OF FINDINGS

GENERAL BACKGROUND. Against the great strides in material progress which have been and are being made in most parts of the world, Burma's retarded economic development should be of deep concern to all her people. Yet, her potentials for greatly increased production and much higher levels of living and welfare are impressive.

Before World War II, Burma was a relatively undeveloped country. Modern technology had made an impact only in minor degree and in but few fields of activity. Agriculture, and particularly rice growing, was the principal producing activity of the working population. The extraction of minerals, oil and timber was also a significant source of income and employment. Primary processing of some agricultural, mineral and forest products accounted for much of the limited manufacturing activity of the country.

The war brought widespread destruction of Burma's man-made assets, drastically lowering her limited productive capacity. Early postwar recovery was most encouraging. The insurrection in 1948 once again brought destruction of existing assets and disruption of current production. Today, the rate of total production in Burma is at most two-thirds of what it was prior to World War II. With a larger population, the per capita output is even lower relative to prewar. Progress is again under way but recovery is slow because of continued insurrection.

Burma's potential for much greater production is solidly based on her rich natural resources and the inherent capacities of her people. However, this potential will not be realized unless important basic policy decisions are made and implemented. The termination of civil unrest is an absolute prerequisite to substantially higher output. The supply of managerial, technical and skilled workers may well be the next most limiting factor in the increase in total production and must therefore be greatly increased. There is an adequate supply of capital available for initial expansion, but an ambitious program of development will soon necessitate aggressive measures to enlarge the local supply of capital and to supplement this supply with foreign capital.

Effective use of resources requires intelligent planning. The Government and the people of Burma are aware of this need. The very presence of this survey group in Burma attests to the favorable environment for effective planning.

There is a need for a basic plan for economic development which encompasses (a) an intensive survey and appraisal of the resources of Burma, (b) ambitious yet feasible goals which take into account both the resources of the country and the wants of her people, and (c) economic policies and engineering projects essential to achieve the goals. Plans are of little value unless they are implemented. Therefore, a development program must include organizational measures designed to best assure the maximum execution of the program.

DEVELOPMENT GOALS. Based on preliminary analyses to date, interim and broad goals of production can now be established. Burma's national output before the war totalled about Rs. 5,500 million (550 crores*) in terms of current prices. Today, gross national production is between Rs. 3,000 million (300 crores) and Rs. 3,500 million (350 crores). Two or three years of intensive effort, after peace has been established, can bring this 60 per cent increase in total production. Assuming continuing progress toward restoration of civil order and the virtual end of insurrection in two years, total production of Burma can again reach Rs. 5,500 million (550 crores)

---

* One crore = 10,00,00,000 (ten million)
One lakh = 1,00,000 (one hundred thousand)

by 1956. A further goal of Rs. 7,000 million (700 crores) can be attained in another three years. Thus, with no disorder after two years, Burma can, by implementing the development program, double its present output by 1959. The enlarged population will then enjoy the same per capita standard of living which prevailed before the war. More important, there will be a firm basis for moving forward to far higher standards of well-being.

The achievement of these goals will require investments aggregating about Rs. 7,500 million (750 crores). These include expenditures for (a) rehabilitating or replacing the productive resources damaged and destroyed by war and insurrection and (b) the added productive capacity needed to increase national output to 30 per cent above 1938-39. Not all these investment needs can be financed locally. A determined effort to direct as large a portion of total production into investment as is feasible, may make as much as two-thirds of these investment needs available from domestic sources. The remaining one-third will have to be secured from foreign sources.

THE PEOPLE OF BURMA AND THEIR WELFARE. Burma's population today totals about 18.5 million. It does not now or in the foreseeable future present the problem of over-density relative to available resources. Birth and death rates are unusually high and the life expectancy is very short. Any significant improvement in general health conditions would immediately result in a substantially stepped-up rate of growth in the population, well above the presently contemplated 14 per cent rise for the next decade. It would likewise increase the size of the labor force.

The population is predominantly rural. Little more than 7 per cent of the people live in cities of 10,000 or over. The largest non-indigenous racial group is Indian. The Indian population has dropped from 7 per cent in 1931 to perhaps half that proportion today.

In general, the labor force of Burma is not effectively utilized. There is considerable total, part-time and seasonal unemployment. There is widespread under-employment in the sense that work opportunities often do not fully occupy the energies of the people now employed, most workers are not supplied with modern tools and equipment, health is poor, training is inadequate, and production techniques are generally primitive.

The low production of the country is paralleled by the low income of the people. The higher paid commercial and industrial employees receive from Rs. 120 to 150 per month. Semi-skilled workers tend to earn between Rs. 80 to 120 per month. Casual and part-time workers may receive Rs. 60 or even less per month. It has been estimated that the barest family subsistence in cities requires Rs. 100 per month. The income of cultivators may be lower today relative to the total population than it was before the war. Except for rice, consumption goods are limited in quantity and especially in variety.

The education system, from the primary to the professional level, reaches too few of the nation's youth. The war destroyed many of the country's school facilities. About 70 per cent of the young children cannot now be offered the opportunity for even elementary education. Far more training is required not only in basic education but also in practically every category of training designed directly to enhance the productivity of workers.

Poor health shortens the span of working years, saps energy and vitality, and interferes with continuity of employment. Progress made in other countries demonstrates what can be done by prevention and treatment of those diseases, such as malaria, tuberculosis, venereal diseases, smallpox, cholera, plague and dysentery, which now take such a heavy toll of Burma's productive manpower.

THE FINANCIAL SYSTEM. An effectively functioning fiscal system can contribute greatly to the economic development of a country. A poorly managed fiscal system can retard expansion of economic activity. The fiscal policies of the Government of the Union of Burma, prior to the 1951-52 Budget, made no positive contribution to economic development. Surpluses and large cash balances were being built up at a time when total purchasing power of the country was inadequate and much of the country's resources, including manpower, was idle. Government investment expenditures have lagged far behind needs and available funds. The 1951-52 Budget is more in line with desirable and required policies. There is little assurance at this time that all or even most of the investment expenditures provided in the current Budget will actually be spent. More vigorous and realistic fiscal policies are required.

The tax system of Burma appears on the whole to be well conceived and to be in accord with the principle that taxes shall vary with ability to pay. Taxes yield only 60 per cent of total Government revenues, the balance being derived from profits of Government enterprises. The most important single source of revenue for the Government are the profits of the State Agriculture Marketing Board which handles all rice exports. Data are not available for analyzing the impact on the economy of this important source of revenue.

As of this date, Burma's monetary and banking system is entirely inadequate to meet the requirements of an expanding economy. There is little to be gained in describing the broad features of the current situation be-

cause draft of new legislation is in near-final form, providing for needed monetary reforms and central bank controls. This legislation will fulfill the needs of the country for a sound and flexible system for supplying money and credit for commercial purposes.

The pending legislation cannot cure all of the existing defects nor fill all of the existing gaps in the supply of credit, especially in agriculture. The cultivators of Burma have been the victims of confiscatory rates of interest. The widespread loss of ownership of land by cultivators before the war was in considerable part due to such interest charges. Government short-term loans to agriculturists since the war have helped meet a critical situation, but an adequate permanent remedy is required. Short-term financing facilities for trade and industry should be considerably improved with the enactment of the new legislation but many gaps will still exist outside the largest cities.

Long-term financing facilities for agriculture and industry are practically non-existent. Institutional channels for savings also do not exist in any measurable degree. Government has helped develop and finance cooperative lending institutions, but they have not as yet functioned adequately. Aggressive steps to fill existing gaps are necessary.

AGRICULTURE. A comprehensive study of the agricultural resources of the country is not included among the responsibilities of the survey group. However, because agriculture has a major influence on the welfare of the people and is related to irrigation, power development, flood-control, industry and transportation, a brief review of agriculture is presented in this Preliminary Report.

The total area of the country is approximately 170.4 million acres, of which 128.5 million acres lie in Divisional Burma and the remainder in the Shan States and Kayah State.

Records for Divisional Burma show about 17.5 million acres in cultivation prior to the War, 19.2 million acres suitable for agriculture but not in cultivation, and 3.8 million acres that lie fallow. Approximately 1.5 million acres are or have been under irrigation. There are no comparable records for the other sections of the country.

More than two-thirds of the people earn their livelihood from agriculture. Before the war, agricultural products accounted for about half the value of all exports. In the postwar years they have accounted for much larger portions of total exports.

Rice is the principal crop. Other crops include groundnuts, pulses, sesamum, millet, maize, cotton, tobacco, sugar cane, rubber, fruits and vegetables. Farming methods are primitive and crop yields in general are low. Livestock raising either for dairy products or meat is limited.

Land ownership and rental practices, and high interest rates have imposed heavy burdens on cultivators, though some steps toward improvement have been taken by the Government.

The war and insurrection brought serious reductions in agricultural output. The acreage in paddy is approximately one-fourth below the prewar level and production of paddy is down roughly one-third. Most other crops are also lower. The number of plough cattle is about one-fourth below prewar. Considerable rehabilitation will be required to reach prewar levels of production.

There are a number of avenues open to Burma for increasing agricultural production which include: opening up new land from the vast reservoir of unused acreage, the general use of high quality seed, the greater use of fertilizer, extension of irrigation by constructing water storage reservoirs, the introduction of new crops, the use of modern farming methods and dry season pumped irrigation in the delta region, and a system for providing agricultural credit at reasonable rates of interest.

The agricultural production of the country could be more than doubled by carrying out a major program of improvement and expansion.

FORESTRY. The forests of Burma cover about 58 per cent of the area of the country, 14 per cent being in reserved forests and 44 per cent in unclassed forests. These forests yield about 10 species of hardwoods known in the world market, about 40 species used in the domestic trade of the country and more than 70 species that are used in the localities where they grow. Among the 10 export species only teak is an important source of foreign exchange. Burma possesses about 75 per cent of the world's supply of teak. A well-conceived conservation program has been followed in preserving Burma's forest reserves.

In normal times, only 55 per cent of the timber cut was consumed in Burma and 45 per cent was exported. From 1934 to 1940, the average annual export of teak amounted to about 450,000 tons. That of other hardwoods averaged 82,500 tons. Annual consumption of timber for housing averaged about 300,000 tons. The consumption of wood for fuel is more than twenty times higher than that for housing.

Bamboo, of which there are over 20 common species in Burma, is by far the most important forest product in terms of local consumption, with about 1,700,000 tons used annually for housing. Cutch and lac are the most important of the minor forest products. Some experimentation has been carried on with tung plantations.

The insurrection has severely curtailed the export of

teak and thus deprived the country of an important source of foreign exchange.

Extraction of wood products is accomplished basically by simple methods without benefit of machinery. The chief means of transportation is by rafting down the major rivers. The State Timber Board handles all principal phases of teak utilization. It operates large sawmills and markets about 70 per cent of the whole production.

MINERAL INDUSTRY OF BURMA. Prior to World War II, Burma's non-ferrous metal mines and petroleum industry were large employers of labor and a principal source of foreign exchange.

Now the industry lies prostrate. War damage destroyed the oil fields, the Burma Corporation's concentrating plant and hydro-electric plant, and the Mawchi Mines mill. Considerable rehabilitation has been accomplished, but insurgent activity and unsettled political conditions have prevented the resumption of normal operation.

There is ample evidence that Burma can rehabilitate her oil industry and can also in time become one of the world's major suppliers of base metals. The production thus created can help to secure a notable improvement in the economic well-being of her people.

Before the war, the non-ferrous-base metal mining industry was exporting products valued at over Rs. 60 million (6 crores). Today, with much higher prices prevailing, the value of annual exports is in the neighborhood of Rs. 13 million (1.3 crores). The limits to which the industry could be expanded are not known but indications are that within a few years employment and exports could greatly exceed prewar levels.

The oil industry which prewar supplied all of Burma's needs and exported products valued approximately at Rs. 140 million (14 crores), today fails to supply even domestic requirements, necessitating imports to the extent of more than Rs. 30 million (3 crores). This industry can be restored to again supply Burma and allow some export. There are promising unexploited areas which should enable the industry to produce at its prewar level.

Investigation has disclosed that Burma could become a substantial producer of antimony metal, could probably produce its domestic needs of non-coking coals, and could substantially increase its lead and zinc exports.

The Government of the Union of Burma is now acquiring substantial interests in the country's industries. It does not have experienced managerial and technological personnel to represent its interests. There will be a constantly increasing need for trained managers and technicians. Expansion of the mineral industry will probably proceed in large measure with Government supplied or Government guaranteed capital.

INDUSTRIES. Manufacturing industry in Burma is in an initial stage of development. Existing industries in general are small-scale operations employing crude methods and little modern machinery. A large part of current industrial production is comprised of the output of small scale cottage industries. Productivity is low. Costs are not high only by reason of very low wages. Quality standards are generally poor. The variety of products produced is limited.

Many natural resources are not being processed at all and some in such a manner as to not add greatly to the value of the raw materials. Some of the products now imported could certainly be produced in Burma. Many of the unsatisfied wants of the people could be better fulfilled if new industries were established.

Industrial development is urgently needed to provide productive work opportunities for the growing population and labor force, to reduce Burma's excessive dependence on the production and export of rice and a few other key items, to increase per capita productivity and output, to conserve foreign exchange, and most importantly, to make larger quantities and more varied supplies of goods available to her people.

Burma's industrial potential is determined by her natural resources, her labor force, the capital equipment at hand or which can be obtained and the foreign technological skills which can be mobilized to train her working population. Her raw materials could certainly support a considerable degree of industrial development.

There is little prospect of or need, with few exceptions, for entering into the production at this time of manufactured items necessitating large-scale enterprises or complex processing. Industrialization is inevitably a gradual process in which industries grow in relation to those on which they depend for supplies and in relation to others which in turn are dependent on them. Burma needs to intiate selected industries which will benefit from the natural advantages of local raw materials and local markets. Careful selection, based on sound criteria, will help achieve successful operations, which in turn will encourage other industries.

TRANSPORTATION COORDINATION. The transportation system was adequate to the limited needs of Burma before World War II. Its facilities have been so damaged by war and insurrection that today Burma's economic and commercial life are severely handicapped. The expansion of Burma's economy, accompanied inevitably by the further opening up of under-developed and undeveloped areas rich in nautral resources, demands that this deficit be made good in a logical pattern, encouraging each transportation mode to develop fully its own natural sphere, and assuring fair and healthy competition in over-

lapping spheres. The coordination of the four transportation modes—waterways, railways, highways and airways—is so broad in scope and vital in importance that it is considered essential to establish a Commission of three qualified men, with adequate staff, to devote their full time to the solution of the continuing problems of regulation, control and expansion.

TRANSPORTATION—PORTS AND WATERWAYS. Burma has six major ports (Rangoon, Akyab, Bassein, Moulmein, Tavoy and Mergui) and some 5,000 miles of tidal and river inland waterways that are commercially-navigable.

Burma's ports were seriously damaged during the war. At Rangoon the condition of some of the docks and piers structures permitted their early return to profitable use. Entrance channels and harbor areas in the ports of Rangoon, Moulmein, Tavoy, and Mergui were mined heavily and obstructed by sunken craft.

Mine sweeping operations have reopened all of Berma's channels and ports, but further sweeping operations are necessary. Practically all wreckage has been removed, channel have been redesignated, and many dockage facilities have been restored. Basic pilot service is again available. Because of the lack of dredging equipment, most of the ports are in need of rectification.

At all ports, except Rangoon, much of the rehabilitation work has already been accomplished. At Rangoon, there still remains a great deal to be completed, even though considerable work has been done. Substantial assistance in the postwar rehabilitation program of the ports has been provided by the United States Economic Cooperation Administration.

Many of the entrance channels, and particularly the channels to the ports of Bassein and Moulmein are inadequate for the safe and dependable operation of seagoing vessels and construction is required for the relief of the critical navigating conditions.

Present commerce at the ports varies from about 35 per cent of the prewar high at Rangoon and Moulmein to over twice the prewar peak traffic at Mergui. Commerce at Akyab is at about 50 per cent of the prewar high; at Bassein, 60 per cent. Considerable increases in commerce must be anticipated as the level of economic activity of the country moves toward the goals which have been proposed.

Probably about half of the river commerce is transported by craft of the Inland Water Transport Board and by ships of the Arakan Flotilla Company. Most of the nearly 700 craft operated by the Irrawaddy Flotilla Company prior to the war were destroyed. The Inland Water Transport Board has carried on a large program of rehabilitation and their fleet now exceeds 500 vessels of all types.

Because of insurgent activity many of the riverine trade routes are no longer in use with a resultant heavy drop in passenger and cargo transport. The reported commerce of prewar days indicated about 8,250,000 passengers and over 1,250,000 tons of cargo transported annually. Commerce by private and contract carriers and by country boats for which there is no quantitative record, may have been as much as three to four times the above amount. Since the war, Inland Water Transport Board cargo traffic has recovered to slightly over 50 per cent of prewar, and passenger trade to about one-third of prewar. The Arakan Flotilla Company cargo trade is up to half of prewar, and passenger trade up to nearly two-thirds. River commerce is expected to increase to 15 to 20 per cent over the prewar high in the first decade after the cessation of insurgent activity.

TRANSPORTATION—RAILWAYS. The Railways of Burma are operated as a Government monopoly, exercised and controlled by the Railway Board. The Railway Board operates substantially as a business. The railways have a history of some 70 years, initially as Government owned, later as privately owned; they have reached their present organizational structure and operational form by evolution since they were returned to Government operation in 1928. Operations in "Company Days" were highly profitable. Various factors, including depression, war and insurrection, have combined to create financial losses in nearly all years since the return to Government control.

The railway system covers the central part of Burma from Rangoon through Mandalay to Myitkyina, with branch lines, among others, extending southwest to Bassein and southeast into the Tenasserim country.

Pre-World War II service was adequate to meet the needs of the country and the quality of service was reputed to be excellent. The physical plant was very heavily damaged during World War II, partly rehabilitated thereafter, and again heavily damaged by insurrection. Damage due to insurrection continues with some abatement. Service is currently provided on about 1,500 miles of line, but is slow, irregular and uncertain.

The immediate problem of the railways is rehabilitation rather than expansion. The Railway Board has estimated the rehabilitation cost at approximately Rs. 500 million (50 crores). This estimate allows for limited improvements along with rehabilitation. The time required is dependent in part upon the restoration of civil order and the supply of equipment, but in any case will take some ten years. The railways will remain a prime traffic carrier for several decades at least, in spite of competition from

other transportation modes, with highways and airways competing for the first time in serious degree.

TRANSPORTATION—HIGHWAYS. The Ministry of Public Works, Rehabilitation, and Labor has as its principal sub-division the Buildings and Roads Department, which is responsible for the design, construction and maintenance of public buildings and the national and main roads. Districts are responsible for district and local roads. The autonomous states are responsible for all roads in their areas other than certain agreed national and main roads. The Buildings and Roads Department operates on the basis of project submission, budget estimates and annual appropriations.

The existing highway system consists of about 7,500 miles of national and main roads, and 5,000 miles of district and local roads. The many miles of ox-cart and mule tracks are not counted as part of the road system as such, but are important in total transportation. Most roads date from pre-World War II, and have suffered from excessive use and deficient maintenance generally since 1941. Insurgency currently limits the localities where new work or maintenance may be done, and creates considerable loss by destruction of bridges.

Present day registration of motor vehicles throughout Burma totals around 21,000 with about 45 per cent in Rangoon. Jeeps, weapons carriers, and trucks from army stocks make up about half of the total. Importation of trucks is now restricted. There are no organized passenger or freight bus or truck companies of significance. Traffic by motor vehicle is nevertheless sufficient even at this time to cause a significant diminution in railway business on certain branch lines. Busses and trucks are frequently overloaded, and are not effectively regulated. Automotive traffic is of extremely low density. Nevertheless, it is certain that highway traffic will increase greatly with the return of law and order. In an expanding economy this mode of transportation, largely new to Burma since World War II, is certain to expand many fold.

TRANSPORTATION—AIRWAYS. Air transport in Burma is operated as a Government monopoly under the name of the Union of Burma Airways (UBA). It replaced small private enterprises in 1948. The Union of Burma Airways Board is assigned full responsibility for air transport, both internal and to adjacent countries. The Chairman of the Board is also the full-time Chief Executive Officer of the UBA. The Director of Civil Aviation, whose office dates from pre-World War II, is responsible for the establishment of criteria and standards for aircraft operation, airports and their maintenance, and radio communication for aircraft control. The UBA conducts its operations, including fiscal, substantially on business procedures.

The UBA, in its early days, was compelled by the interruption of surface transportation to expand its facilities substantially. From an initial fleet of only six de Haviland Dove airplanes, operations increased rapidly, largely by charter, to carry the bulk of limited transport within Burma at the height of insurrection. More recently, with the reopening of surface transport, UBA operations have reduced in volume. Chartered planes have been released. UBA-owned craft were increased in number in 1950 by the purchase of nine Douglas Dakotas. Operations have always been profitable, with a traffic volume of about 2½ million passenger miles and 600,000 freight-ton miles per month in 1949-50. Airports are generally well positioned throughout Burma and have proven practicable for present use. They require improvements. The need for additional numbers of trained personnel is especially necessary. Aircraft in use are excellent but will obviously require replacement in due course and at prices high in relation to cost of currently used aircraft. This creates a funding problem only partially solved by current fiscal procedures.

The commercial air service, including passengers, mail, parcels and freight, is relatively new to Burma but constitutes a dynamic, expanding means of transportation which will expand and compete successfully with surface transportation as normal conditions return.

COMMUNICATIONS. The Telecommunications Department is organized within and responsible to the Ministry of Transportation and Communications. Subject to certain special authorizations in the obligation and disbursement of public funds, it operates within normal Union Government administration and procedure. The Department operates the telephone, telegraph and wireless system in Burma as a Government monopoly. Funds collected accrue to the general revenues of the Union Government, costs are covered by annual appropriations.

The basic organizational structure of the Department, in the office and in the field, appears well conceived and arranged. However, limitations of personnel and administration prejudice the quality of the operation and of service rendered.

The Telecommunications Department was more seriously affected by World War II and the insurrection than most Government Departments. Its land lines continue to be interrupted constantly, without apparent hope of early relief. Its telephone equipment is approaching the end of its useful life, and has reached a stage making maintenance difficult and in some cases impracticable. Some of the wireless equipment in use is new and modern; some is obsolete and extremely difficult to maintain in

working order. Problems in personnel training and management are of great complexity and magnitude.

The wireless telegraph network provides communication to about 30 important centers only. There is no telephone communication of significance, other than local within the main population centers.

Communication outside of Burma by telegraph is satisfactory, by telephone is non-existent. Communications services now fall far short of the adequacy or flexibility which existed before World War II. Neither Government, industry nor commerce can function with the desirable effectiveness under such communication deficiencies.

WATER RESOURCES. The use of water resources has been a major factor in providing high standards of living for other nations and the development of a coordinated water program, more comprehensive than now exists in Burma, is considered essential. Such a program is favored by the physical conditions, viz: an ample supply of water of good quality for domestic, agricultural and industrial uses; mountainous topography with economical dam and reservoir sites adjacent to fertile lowlands; and a favorable climate and markets for substantially increased agricultural production. The program would encompass improvement of waterways, irrigation, land reclamation and drainage, hydro-electric power, prevention of floods and soil erosion, elimination of pollution, adequate and safe water supply and sanitation.

The existing water program does not now include systematic collection of surface and ground water data, nor the construction of multi-purpose reservoirs for river regulation, hydro power and dependable year around irrigation. The existing program does include planning for two major hydro-electric projects, several storage dams on minor rivers for supplementary irrigation, pumped irrigation in the dry belt and the lower delta. Irrawaddy bank protection by set-backs or groins, and a sizable land reclamation project in the lower delta are budgeted and under way. Municipal water supply has been largely neglected and appears to be a prime field for Government supervision and financing.

It is apparent that multi-purpose reservoirs will show immediate substantial benefits to irrigation, hydro power and localized flood control. Minor benefits will accrue to navigation, down river flood control, and municipal water supply in some instances. The above findings are accentuated by the annual distribution of rainfall creating the lengthy flood season followed by the long drought.

POWER DEVELOPMENT. Only ten small hydro-electric power plants with combined capacity of 17,000 kilowatts existed before the war. Some of these were destroyed during the period of occupation. The principal steam power plant is located in Rangoon and has a capacity of 26,000 KW, only part of which is used. The present power demand varies from 3,000 KW to 9,800 KW. This power is not low-priced. Operating costs are about 3 to 4 annas* per KWH and the revenue varies from 4 to 8 annas. It has been estimated from past experience that the demand for power will increase from 10 to 20 per cent per year under present conditions. As the economic development is implemented, the power demand can be expected to increase to many times the present level.

Several sites on which low-cost hydro-electric power projects appear to be reasonably feasible exist near strategic load centers. Hydrographic, topographic and geologic surveys have not been made of any of the sites which seem worthy of further investigation. Only preliminary studies of the sites have been made. It would appear that these projects could produce low-cost power.

Steam power can be generated from the Kalewa coal deposits if their development is found to be feasible. It appears that hydro-electric power will be lower in cost than steam power. Accordingly, hydro-electric power should take the base load and steam power the peak loads.

ORGANIZATION. Within the Government there is an appropriate structure for overall planning, but there are serious deficiencies in both statistical information and trained Burmese personnel required for continued effective planning. There is a proper appreciation for the function of planning as evidenced by the retention of the Ministry of National Planning portfolio by the Prime Minister. The work of the Economic Council has contributed much to the planning activities in the Government.

The present state of activity in the collection and presentation of statistics is so grossly inadequate as to limit seriously much of the work in the field of planning. There is an obvious need for an intensive program to collect and analyze more data and better data in every area of economic activity. Equally obvious is the need for more and better trained persons to do this job.

The permanent staff of the Ministry of National Planning is far too limited in the number of trained persons essential for the huge responsibility assigned to it. Technicians from abroad, including this survey group, are attempting to associate with themselves Burmese personnel for further training. However, there is an inadequate supply of individuals with sufficient formal training to assure that within a couple or more years, the persons necessary to carry out the planning function will be available within Burma.

Insofar as Government implementation of a develop-

*16 annas = 1 rupee.

ment program is concerned, there has not yet been sufficient time to review the structure and operations of even the more important Government Ministries, Departments, Boards and their subdivisions. There appears to be some question as to the wisdom of present assignments of functions, doubts as to existing personnel and wage or salary practices, and some lack of consistency in organization among the various agencies of the Government, especially the independent Boards.

In the private sector of the economy, efficiency of organization seems to be conspicuous by its absence. Again, it is undoubtedly a matter of an insufficient number of persons with initiative, experience and training.

SUMMARY OF RECOMMENDATIONS

The recommendations which follow are based on the findings of the survey group as a result of its initial and preliminary investigations. The central objective is to recommend projects, policies and studies—in the fields for which the survey group is responsible—necessary to achieve the basic goals proposed for the economic development of Burma. The areas for which the survey group has been assigned responsibility, are not all-inclusive. For example, the important fields of agriculture and forestry, are not included. These activities have been reviewed briefly in the survey study, but no recommendations are included with respect to them. No project recommendations have been made in the fields of education, health, housing or the field of welfare services generally, since these are outside the scope of the project work of the survey group. Policy recommendations, however, have been made for these fields.

Since the recommendations offered are based on only initial studies, they lack as yet that inner balance which will be achieved progressively as the survey group proceeds with its work. Some fields will receive greater emphasis in the final report than they are accorded here. In the early stages of the development program, the need for getting started, combined with the vast amount of idle resources in the country, favors going ahead on all clearly sound and useful projects, rather than seeking to attain a perfect balance in all fields at once. Balance will be attained as the program develops.

The recommendations in each field include those involving policies, those dealing with specific projects, and those calling for studies on the basis of which further recommendations can be made. The recommendations are not, however, presented in terms of these categories, but rather for each subject area with which they treat.

An even more important classification of the recommendations concerns the timing of their application. Some recommendations call for prompt action to initiate projects, to organize instruments for the execution of projects, to organize training programs, and to adopt policies necessary to the success of the development program. Some of these recommendations are ready for immediate implementation; others will require some detail and elaboration. In either case, it is contemplated that action will be taken on such recommendations in a matter of weeks rather than months. A second group of recommendations call for more intensive study and consideration. It is contemplated that firm recommendations on these will be presented as such studies and considerations are completed within the next two to six months, and that these will also be followed by early action. The third group concern projects and policies which will require lengthier study and consideration. It is contemplated that firm recommendations with respect to these will be presented over the next eighteen months as the efforts of the survey group permit.

The projects and policies included among the recommendations requiring lengthy study are by no means all-inclusive nor necessarily of the first importance. As the survey group makes a more intensive study of the development possibilties of Burma, new recommendations will be submitted and appropriate priorities of importance and timing will be recommended.

RECOMMENDATIONS ON LABOR, EDUCATION AND HEALTH

For Immediate Action, It Is Recommended That:

1. Improved statistics on employment, unemployment, part-time and seasonal employment, wages, hours of work, productivity, etc., be developed as soon as possible as part of a comprehensive statistical system.
2. The "cost-of-living index" be revised to provide a realistic measure of the income required to support a minimum health and decency level of living for a typical Burmese family. Such budgets should be developed for several key cities throughout the country.
3. a. A comprehensive program of education and training be inaugurated to prepare the skilled personnel who will be required for the economic development program.
   b. Improved systems of primary and secondary education, with more and better-equipped schools, more and better trained teachers, and reaching many more students, be developed. The curriculum needs to be critically examined and revised in accordance with needs.
   c. A vigorous expansion of facilities for professional training be undertaken.
   d. Great emphasis be placed on vastly-expanded

programs of technical and vocational training. A variety of techniques, including schools, in-service training, foreign study and apprentice-training will need to be employed.

e. A vocational training school be set up in every industrial center, with training facilities in the skills needed or likely to be needed in the area.

f. More training schools for the training of teachers and the improvement of teaching be established. Teacher's pay scales should be studied with a view to such revisions as may be warranted.

g. More liberal provisions for education and training be made in the budget.

4. A comprehensive national health program be developed and implemented. Present plans for the prevention and treatment of ill health should be vigorously pressed.

5. A broadly conceived housing program be developed and executed. This should include provision for water supply, garbage and waste disposal, utilities and related community facilities (educational, health, recreational, transportation, etc.), and should be related to the overall economic development program.

For Further Study and Consideration, It is Recommended That:

1. a. In considering the problem of seasonal unemployment, major and primary emphasis should be placed on overall economic development and job creation. This will reduce the problem of seasonal unemployment and place it in proper perspective.

   b. Future programs designed to relieve seasonal unemployment should include encouragement to geographically-dispersed small scale production units aimed at local markets, and widely-dispersed public works programs geared to off-season unemployment peaks

2. Serious consideration should be given to the revision of the basic pay scales of Government to include current cost of living allowances.

3. Continued study be devoted to measures necessary to promote welfare in the fields of labor, labor relations and social security.

RECOMMENDATIONS ON FISCAL POLICY, MONEY AND CREDIT

For Immediate Action, It Is Recommended That:

1. The Government proceed with investment at the present time at a rate considerably in excess of current revenues in order to stimulate and benefit production, employment and the general welfare.

2. Proposed changes in the monetary and banking system, now in legislative draft form, be adopted. These will provide the flexibility in money and credit required by the economic development program, and on a sound basis.

3. The geographic coverage of the commercial banking system be increased.

4. The sales tax should be converted to a single-point tax levied at the point of import or production, with certain goods exempt and with different rates on different types of goods.

5. Some changes in excise duties and commercial taxes, as indicated in the Preliminary Report, are required, and should be made.

For Further Study and Action, It Is Recommended That:

1. The entire revenue structure and its administration be reviewed in the light of postwar experience to date, with a view to revisions which may improve its yield, its equity and the incentives it provides.

2. The entire land revenue system be reviewed thoroughly with a view to basic revision. Pending this revision, an emergency adjustment to adapt rates to postwar conditions should be considered.

3. The system of tax administration be closely and expertly reviewed to lessen evasion and simplify procedures.

4. A thorough study of the economics of paddy growing, and of the world rice situation, be made to provide the basis for evaluating Government's revenue policies.

5. Methods of making adequate credit available at reasonable interest rates to agriculture and indigenous trade and industry be formulated and adopted. The following deserve careful consideration:

   a. Establishment of a State Agriculture Bank run on business-type lines, to administer all loans under the Agriculturists' Loans Act.

   b. Fostering of multi-purpose village cooperatives where they do not now exist, as rapidly as staff can be carefully trained.

   c. Establishment of State pawnshops as rapidly as staff can be carefully trained.

   d. Welding a, b, and c into one system, substantially as recommended in 1948 by the commission appointed to study the problem of agricultural finance.

6. The administration of import, export and foreign exchange controls be critically reviewed in the light of experience to date, with a view to possible simplification and other improvement.

7. Studies be undertaken to forecast the probable timing of conditions of near-full production and employment, so that Government's expansionary fiscal policy may be appropriately adjusted to prevent inflation.

RECOMMENDATIONS ON MINERAL INDUSTRIES

For Immediate Action, It is Recommended That:

1. A Mineral Development Corporation called the "Union of Burma Mineral Development Corporation" be created to administer the present interests of the Government in petroleum and metal mining and to assume responsibility for the exploration, expansion and development of the mineral industry. The Corporation should utilize the very best managerial and technical services available to assist it in this work, retaining consultants as required until its own staff has been developed and trained.

2. The development of six antimony mines and the construction of a central oxidation and reduction plant be undertaken.

3. Further studies and tests be made to determine the feasibility of developing the Kalewa coal deposits. Preliminary exploration and testing have been favorable.

4. A program for mineral exploration and for the training of managerial and technical talent be inaugurated.

5. The functions and activities of the Mining and Geological Departments be expanded. As recommended, these Government agencies would render assistance to established industry and initiate additional mineral developments.

For Further Study, It is Recommended That:

1. Comprehensive studies and investigations be made to determine the desirability and feasibility, among others, of the Myingyan mineral industry project; the development of the known lead and zinc ore deposits of the Southern Shan States; the expansion of tin and tungsten production; and the reduction of high grade antimony ore.

2. A long range program be developed for prospecting little-known and unexplored areas of promise.

RECOMMENDATIONS CONCERNING INDUSTRY

For Immediate Action, It Is Recommended That:

1. A Union of Burma Industry Development Corporation be created to foster and assist in the modernization and expansion of existing industry, and to sponsor, initiate or assist in new industrial development projects. It will be necessary for the Corporation to retain managerial and technical personnel of the highest competence, until its own staff can be developed and trained.

2. Early action be taken to modernize the rice milling industry and make it more efficient. This program should include the establishment of premium price scales in several steps for rice with lesser degrees of breakage, and the establishment of one completely modern new rice mill to set a pattern for the rest of the industry.

3. Early action be taken to establish an integrated fishing industry, a salt extraction plant, a bamboo pulp and paper mill, a cigarette factory, a roofing tile plant, three integrated saw-mill and millwork units, and a rubber products plant. Location studies and/or preliminary process designs should be undertaken as soon as possible.

4. A professional estimate of the amounts and types of steel and iron scrap available in Burma, and of their probable collection costs, should be made as soon as possible.

For Further Consideration and Study, It is Recommended That:

1. The desirability and feasibility of new plants for the production, among others, of cement, dairy products, sugar, soap, glass and glassware, pottery, caustic soda and chlorine, sulphuric acid and jute bags and sacks be investigated intensively.

2. The production of groundnuts should be stimulated to prewar levels, and the possibilities for increasing production in excess of prewar levels should be explored, to provide a greater supply of this promising industrial raw material.

3. Possible consumer acceptance of processed grains other than rice should be studied, to provide information necessary to the consideration of industrial expansion in this field.

4. Government's taxation, import and export, foreign exchange and related policies be analyzed and reviewed to ensure that they stimulate and facilitate industrial development and productnon to the maximum extent possible.

RECOMMENDATION ON COORDINATION OF TRANSPORTATION

For Immediate Action, It is Recommended That:

1. A Commission of three qualified men, with staff, be established to devote their full time to the coordination, control and regulation of the four transportation modes—waterways, railways, highways and airways.

RECOMMENDATIONS CONCERNING PORTS AND WATERWAYS

For Immediate Action, It Is Recommended That:

1. Immediate action be taken to complete the rehabilitation of the ports of Burma. This includes the restoration of harbors and their cargo-handling facilities, maintenance equipment, and pilot service to the prewar level. It also includes channel dredging, removal of wrecks, dock and jetty repair and reconstruction, installation of warehousing facilities and cargo-handling equipment, purchase of floating plant, and reconstruction of port and customs units.

2. Radio equipment be installed without delay on all riverine craft, conservancy units, and freight stations.

3. The inland waterways now in operation be adequately maintained.

For Further Study, It Is Recommended That:

1. In order to prepare for the expected increase in commerce, studies be made of additional port facilities required at each harbor, the alleviation of restrictive entrance channel conditions and other matters pertaining to port engineering and operation, and that an evaluation of port revenues be made.

2. Plans be prepared for conservancy measures on inland waterways now in operation and the additional waterways which will be put in service at the end of insurgent activities.

3. Plans be prepared to ready riverine craft for the increased demands which will be created by the development program, and that studies be conducted to determine the most economic types of vessels for the inland waterways services.

4. Extensive studies be made to determine what inland waterway improvements are necessary, feasible and justified.

RECOMMENDATIONS CONCERNING RAILWAYS

For Immediate Action, It Is Recommended That:

1. Phase I of the railway rehabilitation program be carried out during 1952-55 to include replacement, and/or procurement of track, bridges, signal communications, locomotives, rolling stock, buildings, and workshop and electrical equipment.

2. The rehabilitation of the Ava Bridge, and the construction of the Sittang Bridge be expedited.

3. The training program for technical personnel be expanded.

4. Shop and field maintenance work be modernized by procurement and utilization of additional types and numbers of power and machine tools.

5. The Pegu-Thongwa and Moulmein-Ye branch lines be abandoned.

For Future Action and Further Study, It is Recommended That:

1. Phase II of the railway rehabilitation program be carried out during 1955-59, to include repair, replacement and/or procurement of track, bridges, signal communications, locomotives, rolling stock, buildings, and workshop and electrical equipment.

2. Analysis be made of the revisions of practices and procedures required to eliminate ticketless travel.

3. Detailed analysis be made of past and projected future traffic, and all other pertinent factors necessary to determine whether the following branch lines should be abandoned or rehabilitated:

Taungdwingyi - Kyaukpadaung
Myingyan - Paleik
Alon - Ye-U
Mandalay - Madaya

RECOMMENDATIONS CONCERNING HIGHWAYS

For Immediate Action, It is Recommended That:

1. The major rehabilitation and maintenance of existing National Trunk and Main roads be undertaken as rapidly as security will permit.

2. The "Kings Highway" from Lake Victoria to Mingaladon Aerodrome be constructed. The initial construction should be one track, two lane asphalt paving. The construction should be performed with the maximum use of road building equipment to serve as a training ground for Engineers, supervisors, operators and mechanics.

3. A comprehensive program of highway planning and programming be set up in the Building and Roads Department and that the staff be increased to make detailed surveys, foundation and borrow pit investigations, laboratory analysis, aerial mapping and that an adequate and effective system of "traffic counts" be developed and used in planning and programming.

4. The construction and maintenance methods be modernized by the adoption of machines in construction, broadening the scope of training of technical personnel and establishment of a laboratory for testing material.

5. That the shop equipment now in use at the Mingaladon Aerodrome be procured and moved to a suitable location to serve the Building and Roads Department and that it be used as a training facility for mechanics and a shop for the overhaul and maintenance of equipment.

For Further Study and Action, It is Recommended That:

1. Additional two lane paving of portions of Routes (1) and (2), all weather construction on portions of Routes (3), (4) and (7) and a new road from Pyinmana to Loikaw be approved and construction undertaken.

2. A new motor vehicle code be promulgated and enforced for the regulation of highway traffic, including control of ox-carts on main roads.

3. The optimum basis be determined for financial assistance by the Government of Burma to Districts and autonomous States in building and maintaining local roads.

RECOMMENDATIONS CONCERNING AIRWAYS

For Immediate Action, It is Recommended That:

1. A comprehensive training program for technical and

semi-technical personnel in formal and on-the-job training be established.

2. A workshop adequate for the complete overhaul of aircraft including engines, propellers and airframes for all Burma's civil and military aircraft be established.

3. The Director of Civil Aviation assume direct operational responsibility for the radio control and signal network for the airways in Burma.

4. Administrative procedures be revised to expedite clearance of air freight through Customs.

For Further Study and Action, It Is Recommended That:

1. Consideration be given to the practicability of closely coordinating certain logistic functions of civil and military aviation in Burma.

2. A master plan for the physical development and improvement of airports used for regularly scheduled commercial flights be prepared and implemented.

3. Plans be developed for the funding of phased aircraft replacement by UBA on the realistic basis of the probable cost of replacement aircraft.

RECOMMENDATIONS CONCERNING COMMUNICATIONS

For Immediate Action, It Is Recommended That:

1. The wireless telegraph net within Burma be expanded.

2. An automatic dial telephone system be installed in Rangoon.

3. International telephone service be installed.

4. A comprehensive training program for telecommunication personnel be inaugurated.

5. Vigorous action be taken to correct such deficiencies in personnel procurement, administration and management as exist in fact.

For Further Study and Action, It Is Recommended That:

1. Review of the authority granted the Director of the Telecommunications Department in the obligation and disbursement of funds be made to assure him adequate latitude and flexibility in the conduct of business, with full safeguards to protect public funds.

2. Ways and means be sought to develop optimum mutual responsibilities between the Telecommunications Department and the various Ministries, Departments and Agencies of the GUB with respect to the telegraph and wireless.

3. The service charges of the Telecommunications Department be analyzed with a view to placing them on a practical and equitable basis.

4. Determination be made of the optimum type of transmission system to adopt for long distance telephone and telegraph communication within Burma.

RECOMMENDATIONS CONCERNING WATER RESOURCES

For Immediate Action, It Is Recommended That:

1. The following projects be approved for immediate detailed field investigations, and design and construction where justified:
   a. The Sinthe Project, which will provide storage and distribution system to irrigate land in the Yamethin District.
   b. The Mon Project, which will provide a distribution system to irrigate land in the Minbu District, utilizing releases from the proposed Mezali Power Project. The Mezali Project is recommended for construction in the section on Power Development.
   c. Lower Delta Pumped Irrigation, which will insure a rice crop in seasons of late rainfall and permit double crops in certain areas of the Lower Irrawaddy Delta.
   d. Irrawaddy Levee Protection, which will continue the existing program of flood control along the Central and Lower Irrawaddy.

2. A coordinated program of collection and analysis of data essential to water resources planning be initiated including rainfall and evaporation data, surface stream flow and ground water measurements, silt studies and flood damage estimates.

For Further Study and Action, It Is Recommended That:

1. The following projects to be considered. These are:
   a. The Yan Be and Yin River projects, which will provide irrigation for land in the Magwe District.
   b. Pakokku Pumped Irrigation, which will permit multiple crops on large acreage in Pakokku District using water from Chindwin or Irrawaddy Rivers.
   c. The Myitnge River Project at Yewa which will irrigate land in Kyauksi District and also provide hydro power to the Mandalay-Myingyan system.
   d. The Myittha and Mu River Projects, which will irrigate large areas in the Sagaing Division and provide incidental hydro power in that region when the market develops.
   e. The Shweli and Upper Irrawaddy Projects which will irrigate land in the Mandalay and Kachin Divisions, and provide incidental hydro power in that area. Substantial navigation and flood-control benefits are anticipated.

2. Expansion of existing projects be considered, as follows:

a. Lower Delta Pumped Irrigation which may be expanded to large additional acreage.
b. Irrigation projects in the Mandalay, Magwe and Sagaing Divisions, which are now run as river projects. Upstream storage would furnish flood protection and multi-crop irrigation as well as stabilization through the dry years.
c. Land reclamation and drainage work now in progress in the Lower Delta, which may be extended to other delta areas. The formation of levee and drainage districts under Government supervision should be studied.

3. Domestic water supply be given thorough study and construction of worthwhile projects be undertaken at an early date.

4. Study and investigation be continued on other water projects which appear to have merit so that the most efficient and economic use of water resources may be attained.

RECOMMENDATIONS CONCERNING POWER

For Immediate Action, It Is Recommended That:

1. The following projects be approved for immediate detailed field investigations, and design and construction where justified:

a. The Pegu Project, which will supply low cost power to the Rangoon-Insein area, including pumped irrigation for the Delta Area.
b. The Mezali Project on the Mon, which will supply 1,200,000 acre feet of water for irrigation of the Minbu area, and power to the Magwe-Chauk and Mandalay areas, including the oil fields and pumped irrigation.
c. The Tandin Falls project on the Saingdin, which would furnish low cost power to the Akyab area.

For Further Study and Action, It Is Recommended That:

1. Three additional projects be seriously considered. These are:

a. The Kawkereik, Lampha Project, which would furnish low-cost power for the Moulmein area, as well as power for the logging industry.
b. The Nam Tu development at the Pyaungsho Rapids, which will provide low-cost power to The Mingyan, Mandalay and Maymyo areas. This project will also furnish the power required for pumped irrigation on 500,000 acres of land in the Pakokku area.
c. The Balu Chung Project near Loikaw in two stages: the upper falls for first development and the lower 600-foot falls for later use. When this lower falls site is developed, the power would probably feed into the Rangoon-Mandalay grid.

2. The generation of steam power from the Kalewa coal deposits be thoroughly investigated and its most economic use in combination with hydro-electric power be determined.

3. A grid of transmission lines be planned for construction by stages that will interconnect the hydro and steam power plants with the major load centers and with each other, thereby improving the efficiency and dependability of transmission and also furnishing power to the smaller communities enroute.

4. Standards for urban and rural distribution be studied and established that will permit reasonable expansion and growth without undue costs and duplication and with minimum energy losses.

RECOMMENDATIONS CONCERNING ORGANIZATION FOR PLANNING AND EXECUTION OF PROGRAM

For Immediate Action, It Is Recommended That:

1. The Prime Minister retain the National Planning portfolio at least until a comprehensive program for economic development is accepted and its implementation is well under way.

2. The chief function of the Ministry of National Planning should be to formulate and continuously revise the basic plan for the country's economic development. It must work in intimate contact with the other agencies of Government, providing them with the overall goals, and coordinating the plans and programs prepared by other Ministries and Departments within their own areas of authority and competence.

3. Close coordination be maintained between the Planning Ministry and the Ministry of Finance to ensure that the budget is in accord with the financial and fiscal policy requirements of the development program.

4. The Ministry of National Planning be organized into four divisions or units: an Economic Research and Planning Division; a Central Statistical Office; a Project and Resource Use Division; and an Administrative Office.

5. The Economic Council should serve as the top policy-making group in the economic planning field.

a. The Council should be comprised of those Ministries whose functions are closely related to the economic activities of the Government. The head of the Union Bank should also be a member. If development corporations are established, their representatives must also be considered.
b. The recommendations of the Economic Council

should be transmitted to the Government in full through the Ministry of National Planning.

c. The Economic Council should receive quarterly reports on the progress of economic development from all departments, boards and agencies concerned, and prepare its own comprehensive quarterly report on the state of the economy and the progress of the development program.

6. The autonomous development corporations recommended in the fields of mining and industry should be set up and run on a business-like basis and that same basis should apply to the new autonomous enterprises they set up or sponsor. Existing State Boards for production (spinning and weaving, tile making, paper milling) should be reorganized and refinanced as individual corporations, subsidiary to the Industry Development Board.

7. Prompt action be taken to develop a comprehensive, reliable and up-to-date statistical system, along the lines already proposed by the Statistical Advisor.. It is also recommended that all public bodies, agencies, boards, development corporations, etc., created for a special purpose, be required to make full operational and financial reports on a periodic basis, and that these reports be public.

For Further Study, It Is Recommended That:

1. Preliminary studies of the organization, functions, staffing, pay scales, operating procedures, etc., of the several Ministries and departments are recommended to determine whether an exhaustive study is in order to improve organization in the Executive Branch of Government.

2. An intensive study of the nature and operation of the State Boards is recommended to appraise the appropriateness of these organizational devices to the functions to which they have been assigned. Questions as to the composition of the Boards also require study.

IMPLEMENTING THE PROGRAM

Financial requirements for the projects which have been recommended in the preceding pages are summarized in the table below. The columns headed "Immediate Projects" relate to projects which have already been evaluated and found sufficiently advantageous that they are recommended for action. "Projects for Near-Future Study" are those which are considered promising but which need further detailed study before a firm recommendation can be made. Local expenditures are those to be made within Burma. Expenditures abroad indicate the rupee equivalent of the cost of capital equipment and materials which will have to be imported and for which foreign exchange will be needed. The totals for each field of activity indicated in the table are in turn summaries of individual projects listed in the various sections of the report. Investment totals shown include only outlays directly involved in the execution of each specific project. Such costs as are necessarily involved in general planning, feasibility studies and the administration of existing and proposed governmental organizations are not included.

The tentative nature of the cost estimates is obvious. Even those for the immediate projects are subject to careful review as the details of each project are spelled out in the near future.

FINANCIAL REQUIREMENTS FOR PROJECTS RECOMMENDED

(Millions of Rupees)

	Expenditures on Immediate Projects			*Expenditures on Projects for Near-Future Study*		
	Total	*Local*	*Abroad*	*Total*	*Local*	*Abroad*
Mineral Industries	7.2	4.4	2.8	68.9	24.4	44.5
Industrial Plants	85.0	21.3	63.7	66.0	16.5	49.5
Ports & Waterways	11.1	2.8	8.3	89.8	33.8	56.0
Railroads	222.5	133.5	89.0	178.0	97.9	80.1
Highways	35.5	24.9	10.6	149.0	104.3	44.7
Airways	2.5	0.9	1.6	—	—	—
Communications	10.5	3.2	7.3	—	—	—
Water Resources	71.0	53.3	17.7	144.4	108.4	36.0
Power	300.0	213.5	86.5	200.0	144.8	55.2
Total for these areas	745.3	457.8	287.5	896.1	530.1	366.0

The projects recommended are all in the fields of mining, industry, land, water and air transport, communications, water resources and power development—fields in which the present survey group has responsibility for engineering recommendations. These project recommendations must be viewed in the perspective of the entire development program to be seen in their true significance.

As already indicated, a total investment of Rs. 7,500 million (750 crores) will be required for a well-rounded development program which will bring the nation's production up to 30 per cent above the prewar level. Of the total investment needed, approximately one-half will be required in mining and industry, land, water and air transport, communications, power, and water resources development. The remaining half will be needed in agriculture (for other than water resources development), forestry, the many trades and services and small supply industries which are auxiliary or complementary to other production; as well as in housing, schools, hospitals, governmental buildings and recreational facilities. All these must be included in appropriate measure in a well-rounded development program.

The projects proposed for immediate construction account for more than Rs. 700 million (70 crores) or approximately one-fifth of the estimated total investment required for achieving the established goals in the fields for which this survey group has responsibility. Promising projects, meriting detailed investigation in the near future, also aggregate a little more than one-fifth of the estimated total needs in these fields. A large number have already been noted for further exploration, the largest items of additional potential investment being irrigation and related water-resource projects. Other projects will be framed for exploration as the survey proceeds.

The investment outlays of projects so far noted as firm, promising, or possible for some fields are considerably less than the investment which will certainly be needed in these areas. This is notably true of mining, where many more projects are anticipated. Total investment possibilities studied in each field throughout the work of the survey group will surely aggregate much more than the total investment now felt to be merited. Critical analysis of them and selection of the economic and desirable ones will round out the recommendations for the full program.

The projects proposed for immediate action include some undertakings designed to rehabilitate or replace destroyed assets and some which are entirely new to the economy of Burma. There is no reason why the development of new ventures in Burma should wait upon restoration of all of the old. Rehabilitation and new investment can and must proceed side by side. Work which can be done at once and is clearly advantageous, of either type, should be undertaken immediately. Work which requires further study or is blocked by internal disorder must wait, whether it be a new industry or activity or a rehabilitation project.

The projects proposed are not necessarily more important than projects in fields outside the responsibility of the survey group. The Government must plan and initiate large investment expenditures in the construction of schools, hospitals and other social capital, including housing, and must in varying degree stimulate or aid or participate in investment in remaining fields—agriculture, forestry, trade, services, etc. Many actions in all these areas can and should be taken without delay.

In implementing the program, it is important to realize that reaching the goal in eight years will require maximum effort year by year, beginning with a sizable program at once; increasing rapidly until Burma's labor and resources are fully in use; and thereafter continuing the program at the full flow which will be possible in relation to resources and current needs.

The flow of investment will be larger during the last several years of the program than during the first years. Progress feeds on itself. The organization of resources during the first few years, the development of competent and skilled staffs, the impetus given by the successful completion of earlier phases of the program—all these will make acceleration possible. However, such activities as training programs to provide the necessary skills and technical abilities must be initiated immediately or lack of these abilities will slow up the later stages of the program.

It is necessary to emphasize especially the need for early and vigorous action with respect to the recommendations which call for such treatment. Such action is essential in the early stages of the development program to make possible the even higher levels of economic activity contemplated in later stages of the program. It will not be possible to delay action now and to compensate by faster action later on; the maximum program feasible is already in the schedule for later years. The actions initiated in the coming weeks and months will lay the foundations for the larger-scale actions scheduled for the future. The target date of 1959 for reaching the established goals will be delayed unless implementation of the first steps in the development program is started immediately, and unless the suppression of disorder is substantially completed by the beginning of 1954.

Foreign financing will be needed to carry out the total program in the magnitudes indicated, but initiation of the program should not wait for it. On the contrary, positive and effective action now, using domestic resources, will indicate that Government is committed to the program, and has taken effective steps to mobilize domestic resources for the task. These facts should expedite the obtaining of loans from other Governments or international lending agencies.

Domestic resources are ample to initiate the program. The labor and domestic materials are at hand. Adequate financial resources for the initial phase are available. At the end of 1951 the Union Government had on hand in the Union Bank a large idle cash balance available for investment. The current and succeeding budgets may be expected to show sizable surpluses of receipts by the Union Government and its agencies over current expenditures. If the essential provisions of the central bank statute now in draft are enacted, Burma will for the first time have a central banking mechanism which can ensure a capital market for Government loans. For these reasons, fairly large-scale domestic financing does not constitute a problem.

Through trading profits, the Government has accumulated sterling deposits sufficient in amount to finance foreign purchases for the initial stages of the program. Additional foreign exchange in substantial amounts is being earned currently. Reference to the table of project

costs presented above shows that the immediate projects will require foreign exchange totalling approximately Rs. 270 million (27 crores). This is the equivalent of $60 million or somewhat more than £20 million. Present holdings of sterling assets are approximately three times this total. Dollar holdings are minor in magnitude.

Part of these assets constitute monetary reserves, and part are needed for current foreign exchange transactions; but a sufficient amount is available to permit the expenditure of the sums indicated, provided agreement can be reached to use some of the sterling now frozen and provided further that the required materials and equipment initially needed can be procured in the sterling area.

It is definitely recommended that the Union Government proceed with the investment program at once, on a broad front, utilizing its own finances. Concurrently, steps should be initiated to prepare loan applications, with careful and adequate engineering and economic documentation, for submission to appropriate sources of funds abroad. Applications for loans must take into consideration the future need to earn foreign exchange in the countries from which funds are borrowed, to service the debts incurred.

It is essential to recognize the importance in the development program both of domestic saving and of loans from abroad. The major part of the resources required for the program—approximately two-thirds—must come from the current production of Burma. This will require the allocation to net investment of about one-eighth of the country's production during the eight-year period.

The remaining one-third of the capital required must be obtained abroad. Burma's foreign exchange earnings will be only a fraction of the total foreign exchange needed; her present foreign exchange holdings, while they will finance the foreign purchases needed for the initial phases of the program, are small in relation to the total required. The one-third of the capital which must be obtained from abroad is just as important as the two-thirds which must come from the current production of Burma. Each of these components is equally indispensable.

The eight-year program must not be looked upon as a final or complete program which will exhaust investment possibilities in Burma and determine once and for all her future standard of living. In a dynamic economy, such as Burma can become, investment never ceases. Rather than building a completed structure which will thereafter stand unchanged, the development program should be conceived as one which will bring the country rapidly up to a firm and well-based starting point, from which a stable and prosperous Burma can march ahead with a steadily rising standard of living and well-being.

TABLE OF CONTENTS

Page No.

SECTION I

GENERAL BACKGROUND OF THE ECONOMIC DEVELOPMENT PROGRAM

A. Burma Yesterday and Today
- 1. Burma Before the War 1
- 2. Burma Since the War 2

B. Burma's Potential for Greater Production and Better Living
- 1. Factors Determining Burma's Potential for Greater Production 2
- 2. Factors Determining Burma's Potential for Better Living 3

C. The Economic Development Program
- 1. The Challenge to Burma—Need for a Plan 3
- 2. Features of the Economic Development Program 4
- 3. Major Requirements of the Economic Development Program 4
- 4. Economic Development Goals 5

SECTION II

THE PEOPLE OF BURMA AND THEIR WELFARE

A. Size and Structure of the Population and Labor Force
- 1. Size of the Population 7
- 2. Geographic Distribution of the Population 8
- 3. Racial Distribution of the Population 8
- 4. Size of the Labor Force 8
- 5. Women in the Labor Force 9
- 6. Various Racial Groups in the Labor Force 9
- 7. Occupation Distribution of the Labor Force 10

B. Utilization of the Labor Force
- 1. General 11
- 2. Seasonal Unemployment 11

C. Labor Income and Living Standards
- 1. The Major Labor Groups 13
- 2. The "Better Paid" Worker Group 13
  - a. Pay of Government Employees (Civil Servants) 13
  - b. Wages in "Better-Paying" Industries 13
- 3. The More "Poorly Paid" Worker Groups 14
- 4. What Wages Will Buy 14

Page No.

- 5. Farm Incomes and Living Levels 15
- 6. Conclusions and Recommendations 16

D. Education and Training
- 1. Introduction 16
- 2. General Education 16
- 3. Professional, Technical and Vocational Training 17
  - a. Professional 17
  - b. Technical 18
  - c. Vocational 18
- 4. Mass Education 19
- 5. Teacher Training 19
- 6. Finance 19

E. Health and Welfare
- 1. Health 20
- 2. Other Aspects of Welfare 21
  - a. Housing 21
  - b. Labor Legislation 22
  - c. Labor Unions 22
  - d. Social Security 22

SECTION III

THE FISCAL, MONETARY AND CREDIT SYSTEM

A. The Fiscal System
- 1. Introduction 23
  - a. Investment in Excess of Revenues 23
  - b. Taxation as a Means of Freeing Resources for use in Public Investment 24
  - c. Revenue Measures as Incentives 25
- 2. Prewar and Postwar Revenues and Expenditures 25
- 3. The Present Revenue System 28
- 4. Tax Policy 31
  - Land Revenue 31
  - Sales Tax 32
  - Excise Duties 33
  - Other 33

B. The Money and Banking System
- 1. The Monetary System 34
- 2. The Banking System 34
  - a. Commercial Banking—The Central Bank 35
  - b. Commercial Banking—The Commercial Banks 36
  - c. Financing Agriculture — Developments to the Present 37
  - d. Financing Indigenous Industry and Trade—the Situation to the Present 39

Page No.

e. A Comprehensive Program for Loans in the Villages 39
f. Stimulating Saving and Channeling it into Productive Use 41

C. CONTROLLING FOREIGN MONETARY TRANSACTIONS 41

SECTION IV

AGRICULTURE

A. INTRODUCTION 44

B. FARM LIFE
1. Past and Present 44
2. Future 45

C. LAND USE AND CLASSIFICATION
1. Land Areas 45
2. Crops and Livestock 47

D. PRODUCTION
1. Cultivation Practices 49
2. Improved Seeds 49
3. Fertilizer 49

E. IRRIGATION AND DRAINAGE 50

F. AGRICULTURE PROGRAM
1. ECA 51
2. Government Assistance 51

G. SUMMARY
1. Recommendations 53
2. Estimate of Results 53

SECTION V

FORESTRY

A. GENERAL 54

B. FOREST TYPES
1. Timber 54
2. Bamboo 54
3. Minor Forest Products 54

C. CONSUMPTION
1. Domestic Use 55
a. Timber 55
b. Wood Fuel 55
c. Bamboos 55
d. Minor Forest Products 55
2. Export 55
a. Timber 55
b. Minor Forest Products 56

D. POTENTIAL DEVELOPMENT 56

E. CONCLUSIONS 56

SECTION VI

MINERAL INDUSTRY

INTRODUCTION 57

A. GENERAL GEOLOGY OF BURMA
1. Introduction 58
2. Physiographic Provinces 58

Page No.

a. The Shan Plateau 58
b. The Central Basin 58
c. The Arakan Yoma 58
d. The Arakan coastal strip 58
3. Stratigraphic Geology 59
4. Tectonic Lines 59
5. Mineral Provinces 60

B. ECONOMIC GEOLOGY
1. Introduction 60
2. Metallic Minerals: Antimony, Beryl, Chromite, Cobalt, Copper, Gold, Iron, Lead, Manganese, Molybdenum, Monazite, Nickel, Silver, Tin and Tungsten, Zinc 60
3. Industrial Minerals: Amber, Asbestos, Barytes, Bauxite, Building Material and Road Metal, Cement Materials, Clays and Kaolin, Fertilizers, Gem Stones, Grinding Media, Gypsum, Jadeite, Limestone and Lime, Salt, Sodium Sulphate, Sulphur and Talc or Steatite 68
4. Coal in Burma 72
a. Uses and Consumption 72
b. Geology 73
c. Coal Deposits 73
d. Recommendations 75
e. Sources of Information 75
5. Petroleum Industry 75
a. Introduction 75
b. History 75
c. Conditions in the Fields 76
d. Refining Capacity 76
e. Geology 76
f. Structural Units 76
g. Oil Sands 77
h. Location 77
i. The Oil Fields 77
j. Reserves 77
k. Potential Areas 77
l. Engineering Methods 77
m. Summary 78

C. ESTABLISHED MINING OPERATIONS
1. Burma Corporation (1951) Limited 78
2. The Mawchi Mines, Limited 81
3. Other Mining Operations 82

D. AREAL DEVELOPMENT PROJECTS
1. Southern Shan States 83
2. Tenasserim 85
3. Other Areas 86

E. ANTIMONY PROJECT
1. Summary 86
a. Objectives 86
b. First Stage 86
c. Second Stage 87
d. Attainment of Ultimate Objective 87
e. Metal Price Basis of Estimates 87
f. Time Schedule 87
g. Recommendations 87
2. Market Outlook 87
3. Previous Work 87
4. Evaluation of Mines and Prospects 88
5. Project Objectives 88
6. Training Program 88
7. Execution of Project 88
8. The First Stage 89
9. The Second Stage 89
10. The Central Plant 89
11. Flow Sheet for Central Plant, First Stage 89
12. Reduction Plant for High Grade Ores 89
13. The Demonstration Mine 90
14. Cost Estimates for Plant Installations 90
15. Plant Data 91
16. Cost Estimates for Mine Development, Plant and Equipment 91

Page No.

17. Operating Costs and Profits 92
18. Total Cost of Antimony Project 93
19. Ore and Metal Prices 93
20. Recommendations 93

F. KALEWA COAL PROJECT

1. Summary 93
2. Location 94
3. Previous Work and Reports 94
4. Recent Field Examination 94
5. General Conditions Relevant to Exploitation..... 95
6. Quality of the Coal 95
7. Probable Cost of Production 96
8. Operational Layout 97
9. Probable Cost of Installation 97
10. Coal Reserve Requisite 97
11. Coal Transport 97
12. Delivered Cost of Coal 98
13. Economy of Kalewa Coal 98
14. Conclusions and Recommendations 98

G. MYINGYAN PROJECT

1. Summary 99
2. Recommendations 100
3. Plant Costs and Operating Estimates 101
   a. Power Plant 101
   b. Zinc Plant 101
4. Summary of Capital Costs 101

H. PROJECT FOR ESTABLISHMENT OF UNION OF BURMA MINERAL DEVELOPMENT CORPORATION (UBMDC)

1. Purpose 101
2. Functions 102
   a. Purchase and Sale of Minerals for Export..... 102
   b. Loans and Technical Service 102
   c. Participation in Mining Enterprises..... 102
   d. Wholly-owned Mining or Related Enterprises... 102
   e. Procurement and Maintenance of Stocks of Mining Equipment and Supplies 102
3. Scope of Activities 102
4. Relationships 102
   a. The National Planning Board and the Ministry of Industry and Mines 102
   b. The Geological Department of the Ministry of Industry and Mines 102
   c. The Department of Mines of the Ministry of Industry and Mines 102
   d. The Department of Public Works 103
5. Location 103
6. Authority 103
7. Estimated Cost of Foreign Consultant Services..... 103
8. Precedent 103

I. DEVELOPMENT OF MINERAL EXPORTS 103

J. TRAINING PROGRAM FOR MINE LABOR AND SUPERVISORY PERSONNEL

1. General Justification 104
2. Program Requirements 104
3. Recommended Program 104
   a. Program for Earliest Action 104
   b. Long-Term Program 105
   c. The Total Cost of Training Program 105
   d. Rangoon University School of Mineral Sciences 105
4. Program Implementation and Execution 105
   a. General Recommendations 105
      (1) The Union of Burma Mineral Development Corporation (UBMDC) 105
      (2) Interim Arrangement for Managerial Supervisory and Technical Services from Abroad 105

K. CONCLUSIONS AND PROGRAM OF FURTHER WORK

1. Scope and Limitations of Preliminary Report 105
2. Summary of Recommendations 105
3. Continuing Activities of Consulting Engineer..... 106

Page No.

SECTION VII

INDUSTRIES

A. EXISTING INDUSTRIES 108

B. THE NEED FOR INDUSTRIAL DEVELOPMENT 108

C. MATERIAL RESOURCES FOR INDUSTRIAL DEVELOPMENT..... 109
   1. Industries and Plants based on Animal Resources.... 109
   2. Industries and Plants based on Vegetable Resources 109
   3. Industries and Plans based on Mineral Resources.... 109
   4. Industries and Plants based on Other Resources..... 110

D. MODERNIZATION AND EXPANSION OF EXISTING ENTERPRISES 110

E. CRITERIA FOR THE SELECTION OF NEW INDUSTRIES 110

F. CONSIDERATION OF SPECIFIC PROJECTS..... 110
   1. Improvement of Rice Milling Facilities 111
   2. Fishing 112
   3. Salt 112
   4. Bamboo Pulp and Paper Mill 113
   5. Re-Rolling Mill for Scrap 116
   6. Bricks and Roof Tile 117
   7. Groundnuts 118
   8. Rubber Products 119
   9. Cement 120
   10. Glass—flat and shaped 120
   11. Cigarettes 121
   12. Ceramics 122
   13. Soap 123
   14. Sugar Mills—Raw and Refined 133
   15. Mills for Structural Lumber and Millwork..... 124
   16. Caustic Soda and Chlorine 125
   17. Sulphuric Acid 125
   18. Bottling 125
   19. Fertilizer 126
   20. Jute Bags and Sacks..... 126
   21. Cottage Industries 127

G. PROPOSAL FOR A UNION OF BURMA INDUSTRIAL DEVELOPMENT CORPORATIION

1. General Features 128
2. Contemplated Activities 128
3. Internal Organization 129
4. General Operational Outline 129

H. SUMMARY OF RECOMMENDATIONS

1. Immediate Action 129
2. Further Action 129

SECTION VIII

TRANSPORTATION

A. GENERAL CONSIDERATIONS 131

B. NEED FOR COORDINATION AND REGULATION OF TRANSPORTATION 132

SECTION VIII-a

PORTS AND WATERWAYS

1. Importance and Extent..... 133
2. Ports 133
3. Inland Waterways 133
4. War Damage 133
5. Mine Sweeping 134

Page No.

6. Security 134
7. Organizations 134

B. DEEP WATER PORTS
1. Rangoon 135
2. Akyab 140
3. Basein 142
4. Moulmein 143
5. Tavoy 145
6. Mergui 147
7. Summary of Port Rehabilitation 148
a. ECA Assistance 148
b. Recommendations on Ports 149

C. INLAND WATERWAYS
1. General 150
a. General Description of River Systems 150
b. Commercial Aspects 150
c. Effects of Rainfall 151
d. Tidal Effects 151
2. River Systems 151
a. Irrawaddy River 151
b. Chindwin River 152
c. Rangoon River 152
d. Sittang River 153
e. Salween River 154
f. Great Tenasserim River 154
g. Mayu or Kalapanyin River 154
h. Kaladan River 155
3. Navigating Conditions 155
4. Riverine Craft 156
5. Commerce 156
6. Recommendations on Waterways 157

APPENDIX A 158

SECTION VIII-b

RAILWAY TRANSPORTATION

A. ORGANIZATION OF THE BURMA RAILWAYS 161
B. BACKGROUND OF BURMA RAILWAYS 161
C. EXISTING RAILWAY LINES 162
D. RAILWAY CONSTRUCTION STANDARDS 164
E. TRACTIVE POWER 164
F. ROLLING STOCK 165
G. SHOPS FOR MAINTENANCE OF ROLLING STOCK, WAYS AND STRUCTURES 166
H. TRAFFIC 166
I. FISCAL
1. Revenue 168
2. Profit and Loss 168
3. Funding 169
4. Rates 169
J. CURRENT AND SPECIAL PROBLEMS
1. General 169
2. Rehabilitation of Physical Plant and Rolling Stock 169
3. Training 169
4. Ticketless Travel 170
5. Branch Lines 170
6. Mingaladon-Insein Connection 171
K. CONCLUSIONS AND RECOMMENDATIONS 171
APPENDIX B 172

Page No.

SECTION VIII-c

HIGHWAYS

A. GENERAL 174
B. HIGHWAY ORGANIZATION 174
C. EXISTING HIGHWAYS
1. General 175
2. Finance 176
3. Classes 176
4. Condition of Union Highways and Main Roads 177
D. MAINTENANCE OF ROADS AND 1951-52 ORIGINAL WORKS
1. Maintenance 177
2. Funds for Maintenance 177
3. District Roads 177
4. Original Works 177
E. CONSTRUCTION STANDARDS
1. Roads 178
2. Construction Methods 178
3. Construction Equipment 178
F. MOTOR VEHICLE REGISTRATION
1. Registration Fees 179
2. Driving Licenses 179
3. Registered Vehicles 179
4. Prospective Growth of Motor Vehicle Population 179
G. HIGHWAY TRAFFIC
1. Passenger Cars and Trucks 180
2. Organized Truck Transportation 180
3. Traffic Laws 180
4. Safety 181
5. Analysis 181
H. PLANNING AND PROGRAMMING
1. Planning and Programming Section 181
2. Engineering Section 181
3. Borrow-Pit Explorations 181
4. Asphalt Storage 181
5. Contract Work 182
6. Laboratory 182
7. The Ox-Cart Problem 182
8. The "Kings Highway" 182
9. Traffic Counts 182
10. Training of Personnel 182
11. Rehabilitation of Existing Roads 182
12. Concrete vs. Asphaltic Paving 183
13. Immediate and Near Future Projects 183
I. CONCLUSIONS AND RECOMMENDATIONS
1. Resumé 184
2. Recommendations 184

SECTION VIII-d

AIRWAYS

A. ORGANIZATION 186
B. EXISTING PLANT AND FACILITIES 187
C. PERSONNEL 189
D. FLIGHT SCHEDULES 190
E. TRAFFIC 191
F. FLIGHT CONTROL AND SIGNAL COMMUNICATIONS 192
G. FISCAL 192
H. FUTURE DEVELOPMENT 194
I. CONCLUSIONS AND RECOMMENDATIONS 194

Page No.

SECTION IX

COMMUNICATIONS

A. GENERAL 196
B. ESTABLISHMENT OF THE TELECOMMUNICATIONS DEPARTMENT 196
C. ORGANIZATION 197
D. INTERNATIONAL RELATIONSHIPS 197
E. RELATIONSHIPS WITH GOVERNMENT MINISTRIES, DEPARTMENTS AND AGENCIES 197
F. FISCAL CONSIDERATIONS 198
G. PERSONNEL 199
H. SUPPLY OF EQUIPMENT 199
I. EXISTING FACILITIES 199
J. LAND LINE TELEPHONES 199
K. LAND LINE TELEGRAPH 201
L. WIRELESS 202
M. CABLES 203
N. BURMESE LANGUAGE CODE 203
O. CONCLUSIONS AND RECOMMENDATIONS 203

SECTION X

WATER RESOURCES

A. GENERAL 205
B. IRRAWADDY RIVER
1. General Description of River System 205
2. The Delta 205
3. The Central Valley 205
4. The Northern Basin 206
C. ARAKAN RIVERS 206
D. PEGU RIVER 206
E. SITTANG RIVER 206
F. BILIN RIVER 206
G. SALWEEN RIVER 206
H. TENASSERIM RIVERS 207
I. PRECIPITATION 207
J. RUN OFF 207
K. FLOOD CONTROL 207
L. IRRIGATION 208
M. NAVIGATION 208
N. PUBLIC WATER SUPPLY 208
O. MULTIPLE PURPOSE RESERVOIRS 209
P. CONCLUSIONS
1. General 209
2. Collection of Physical Data 209

Page No.

3. Flood Problems 209
4. Irrigation 210
5. Public Water Supply 210
Q. RECOMMENDATIONS 210

SECTION XI

POWER DEVELOPMENT

A. GENERAL 211
B. EXISTING POWER INSTALLATIONS
1. Hydro-electric Power Plants 211
2. Steam Power Plants: Rangoon Area 211
3. Voltage of Electric Installations 213
C. POWER DEMAND AFTER REHABILITATION
1. Present Installations 213
2. Growth of Power Demand with National Development Program 213
D. HYDRO-ELECTRIC POWER SITES
1. General 213
2. Selection of Hydro-Electric Power Sites 214
a. Pegu River 214
b. Nam Tu River 214
c. Mon River 214
d. Saingdin River 214
e. Lampha Chaung 215
f. Loikaw Site 215
g. Other Projects 215
E. TRANSMISSION SYSTEM 215
F. ESTIMATES OF COST
1. Hydro Power 216
2. Steam Power Compared with Hydro Power 216
G. DETAILS OF HYDRO-ELECTRIC POWER PROJECTS 216
H. BIBLIOGRAPHY 217

SECTION XII

ORGANIZATION FOR PLANNING AND EXECUTION OF ECONOMIC DEVELOPMENT

A. GOVERNMENT ROLE IN PLANNING 218
B. GOVERNMENT ORGANIZATIONS FOR PLANNING 218
1. The Ministry of National Planning 219
a. Role of the Ministry 219
b. Organization of the Ministry 219
2. The Economic Council 220
C. GOVERNMENTAL ORGANIZATION FOR THE EXECUTION OF PROGRAMS
1. The Executive Department As a Whole 221
2. The State Boards 221
3. Development Corporations 222
D. MAXIMIZING THE EFFICIENCY OF PRIVATE ORGANIZATIONS 222
E. STATISTICS, ACCOUNTING AND REPORTING
1. Statistics—the Existing Situation 223
2. Improving Burma's Statistics 223
3. Reporting and Accounting 224

Section I

GENERAL BACKGROUND OF THE ECONOMIC DEVELOPMENT PROGRAM

A. BURMA YESTERDAY AND TODAY

1. BURMA BEFORE THE WAR. The economy of Burma was primarily agricultural and extractive before the war. About 40 per cent of the value of all domestic production was derived from agriculture; another 10 per cent from mining; and another 5 per cent from forestry. Some 20 per cent of the value of total output was attributable to industries and services, and another 5 or 6 per cent to processing. Public and public utility activities and rents made up the balance. (See Table I.)

TABLE I

NATIONAL PRODUCT AND INCOME

(Rs. millions)

Gross product at market prices of:

	38-39	46-47	47-48	48-49	49-50
1. Agriculture and Fisheries	513	994	1319	1216	1031
2. Mining and Quarrying	128	11	22	23	20
3. Forestry	61	89	123	85	71
4. Processing	71	150	155	175	165
5. State Banking	—	—	1	2	2
6. State Transport	31	57	53	30	35
7. State Communications	5	5	7	4	6
8. State Marketing	—	173	286	268	244
9. Public Utilities	9	14	13	15	11
10. Public Authorities	95	234	216	207	241
11. Household (Rent)	73	150	151	155	156
12. Other Industries & Services	289	946	1013	925	975
13. Gross Domestic Product	1275	2823	3359	3109	2957
14. Net Income from Abroad	-85	—	-6	-13	-8
15. Gross National Product at market prices	1190	2823	3353	3096	2949
16. Gross Domestic Product at 49-50 prices	5444	3019	3762	3397	2957

Source: Economic Survey of Burma 1951, Rangoon 1951.

About 70 per cent of the working population was engaged in agriculture and in the extractive pursuits. The most important single economic activity was paddy growing, to which two-thirds of all cultivated land was devoted. Other important agricultural crops were sesamum, pulses, groundnuts, cotton, tobacco and sugar cane. Of the mineral products, the most important were oil, tin, tungsten, zinc, lead and silver. Teak was the predominant forest product.

Production in Burma was characterized for the most part by age-old techniques and low productivity. Many of her natural resources were only partly developed. The capital equipment available was relatively limited. Transport, communications, power, fuel and other production aids left much to be desired, relative to these facilities in the more developed countries. In consequence, total output of the Burmese economy, and output per capita, were extremely low. At present prices, total output of the Burmese economy in prewar amounted to some Rs. 5,000 to 5,500 million (500 to 550 crores*), or perhaps Rs. 320 per capita. Moreover, part of the country's domestic production was not available for domestic consumption, because it was withdrawn by foreign investors on behalf of investments they had made in Burma.

The foreign exchange earned by the sale of paddy, minerals and forest products was used, after withdrawals by foreign investors, to pay for the importation of a limited variety of goods from abroad. Some of these were consumers' goods—cotton cloth and yarn, tea, milk products, food oils, fishery products, tobacco, soap and the like. These augmented in small degree the meager range of consumer's products available from domestic sources. For the rest, imports consisted primarily of minimum supplies of chemicals, bags and sacks for packing, paper, rubber manufacture, coal and coke, metals, machinery and transport equipment.

The total output of goods and services available to the Burmese people, therefore, from domestic and foreign sources was restricted in variety, and on a per capita

* One crore = 1,00,00,000 (ten million).
One lakh = 1,00,000 (one hundred thousand).

basis, except for rice, greatly limited in quantity. The social services Burma could supply to her people were also minimal. Schools, hospitals, parks, playgrounds, public baths and pools, libraries and the like were relatively few in number and limited in the facilities provided. Although the bare necessities of life were available in somewhat greater measure to the people of Burma than to many of her neighbors, consumption was extremely low by American and European standards.

Management and capital were inadequate to take advantage of mechanization and modern techniques of production. The character of domestic production and the policy of foreign investors to bring in practically full complements of foreign technicians did little to contribute toward the development of the skills of the Burmese people. Non-agricultural labor remained for the most part unskilled or semi-skilled. Since most of the jobs requiring top-level managerial, technical, supervisory and administrative skills and experience were in the hands of non-Burmans, the Burmans themselves did not develop a group of qualified managers, technicians, supervisors and administrators.

A significant element in the picture of the Burmese economy before the war is found in the changing structural pattern visible in the agricultural field. In the decades before the war, a combination of high interest rates, primitive husbandry, and some improvidence by cultivators not yet adjusted to a new pattern of living led to a considerable transfer of land ownership. In the 1930's, low paddy prices combined with these factors speeded up the transfer of land ownership from the cultivators to the money-lenders, and led to the creation of a large class of tenant farmers who had little or no interest in maintaining or improving the land they farmed. The cultivators who managed to retain possession of their farms found themselves increasingly burdened by debts and high interest rates, so that their own living levels were depressed.

On the whole, therefore, economic standards were low and economic progress extremely slow prior to World War II. Most significant was the absence of forces tending to accelerate development and thereby to afford opportunities for a more abundant life to the people of Burma.

2. BURMA SINCE THE WAR. Burma's people are living today, by and large, much more poorly than they did even before the war. This is because the country is producing considerably less—at least a third less—than she did before the war, and the population has grown considerably. Two major factors are responsible for the decline in production. First there was the war, which brought destruction to a substantial portion of Burma's man-made assets; second was the insurrection, which stifled her immediate post-war rehabilitation, and brought about a decline of nearly one-fourth in economic activity from the 1947-48 postwar peak. In addition to these factors, there was the emigration of a large number of skilled workers, technicians, managers and administrators when the war came and later when British rule came to an end.

The war resulted in tremendous damage to buildings, plant, industrial machinery, port, railway and mining facilities, bridges and other means and aids to production. It also caused the deterioration and loss of many trained personnel. In consequence of these factors and the reduction in rice acreage, total output in Burma in 1946-7 was some 40 percent below the prewar level. By 1947-8, total output had increased by about one-fourth—a truly substantial recovery for so short a period. The insurrection, however, reversed this trend. Once again, a serious toll was taken of the nation's productive equipment and current production was seriously disrupted. Though improvement has again been under way for some time, progress has been modest. Total output stands today at perhaps less than two-thirds of the prewar level.

The decline in the total national product from some Rs. 5,000 to 5,500 million (500 to 550 crores), in terms of present prices, before the war to some Rs. 3,000 to 3,500 million (300 to 350 crores), today does not measure the full decline in individual living levels, because Burma's population today is perhaps 2 millions, or 12 per cent, greater than it was in 1938-9. Average per capita output has therefore declined even more than total output. Housing conditions, schools, hospitals and social service facilities have deteriorated. The amount of consumers' goods available to the population has declined. The import statistics indicate that there has been a substantial reduction in the domestic consumption of fishery products, condensed milk, tea, spices, soap, quality tobacco, cotton goods and yarns. The cultivators have fewer work animals to assist them in their production, and must pay a larger share of their smaller yield in wages to their laborers. In the cities, poverty, overcrowding and economic stringency are prevalent. From a relatively undeveloped country before the war, Burma has become still less productive.

If there is any clear judgment to be made at all with respect to the Burmese economy, it is that the present state of affairs is not a necessary one. This picture can be remarkably altered for the better, and within a relatively short time, if the Burmese people choose to do so.

B. BURMA'S POTENTIAL FOR GREATER PRODUCTION AND BETTER LIVING.

1. FACTORS DETERMINING BURMA'S POTENTIAL FOR GREATER PRODUCTION. It is a truism,

valid for any kind of economy, that the production of a nation is limited only by its natural wealth or resources, the skills and energies of its people, the productive equipment they have to work with, and the diligence and "know-how" with which these basic factors of production are utilized. Productive equipment and managerial "know-how" can be acquired or developed; natural wealth and population resources are basic and essential.

In terms of these basic factors, Burma has a great potential for a vastly increased output and levels of living far higher than those she has ever before achieved. This potential is solidly based on Burma's economic geography and population—on her fertile farm lands; her climate, so suited to paddy production; her rich and diversified mineral resources; her vast forests; her natural waterways and power sites; her growing population and labor force and the capacities of her people for education and for work—skilled, managerial and technical work included.

To best realize this potential will require the acquisition of "know-how" and large scale additions to her productive equipment. This latter includes not only industrial plants and machinery, but also power plants and transmission lines; improved transportation facilities—rail, road, water and air, as well as ports and harbors; improved agricultural capital in the form of irrigation works, farm animals and machinery; better warehouses and stores; and improved facilities for health, sanitation, education and training.

2. FACTORS DETERMINING BURMA'S POTENTIAL FOR BETTER LIVING. In the first instance, Burma's potential for better living will depend on the increases in total production, and in per capita production, which can be achieved. While a nation, just as an individual, can augment current income for consumption purposes by borrowing or by drawing upon accumulated savings, such expedients are temporary at best, and can only reduce or restrict future levels of living. Total output, however, is not the sole factor which determines the well-being of a people. It determines how much will be available for distribution; but the composition of the total product, and how it is distributed, are also factors of importance.

First, there is the all-important question of how total national output shall be distributed as between consumer goods and capital goods. This is essentially a question of choosing between more consumption today and even greater consumption in the future. A part of current output must be set aside to provide for the wearing out, or for the obsolesence of, the current stock of productive equipment, so as to maintain it properly. Another part of current output should be devoted to increasing the current stock of capital goods, so that future output can be further increased. The supply of capital goods, over the long run, must increase more rapidly than the growth in population, if per capita production is to be increased. This division of current output between consumption goods and capital goods is essential to economic development; for investment can come only out of current output unless there are foreign sources of investment.

Within the limitations of the supply of goods and services available for consumption, levels of living will also be influenced by how incomes are distributed within the population. Where great disparities in the distribution of income exist, depressed levels of living and serious economic distortions can result, particularly if the recipients of large incomes are inclined to hoard their excess income rather than invest it productively. It should be clear that a major objective in Burma for some time to come should be to increase total output so that there will be more product to share. Appropriate policies should be adopted to ensure fair distribution of the fruits of production, so that adequate incentives to work and save will operate throughout the economy for the investor, the farmer and the worker.

In the case of a country whose economy is as dependent upon foreign trade as is Burma's, a special comment is called for on the relationship between foreign trade and domestic levels of living with respect to stability, productivity and security. A relatively sharper drop in the world market price for rice than for other products, for example, could result in lower domestic levels of living in Burma even though the size of the export crop were to be increased, because less foreign goods could be obtained in exchange. Or, the way in which Burma's foreign exchange is used—whether to finance the purchase of essential consumers' goods, consumer's luxury goods, industrial raw materials, or basic production equipment, or even to build up unnecessarily large and idle balances abroad—will greatly affect levels of living in Burma, present and future. Burma's future development should achieve a proper balance between greater specialization with the resultant higher output of its major products, and diversification into the many industries essential for greater self-sufficiency. Such considerations explain the need, within a program of economic development, both to direct the nature of development in the Burmese economy and to control the volume and composition of imports.

C. THE ECONOMIC DEVELOPMENT PROGRAM.

1. THE CHALLENGE TO BURMA—NEED FOR A PLAN. How can Burma best achieve the greatest possible increases in balanced production, and maximize to the greatest possible extent the welfare and happiness of her people? This is the challenge which confronts the

Burmese people and their Government today. It is a challenge to which all elements in the population—cultivators, workers, business men, professionals, investors, Government servants—should respond.

Surely the challenge cannot be met successfully by a "policy" of drift—of letting nature take its course. The resources of the country must be harnessed and coordinated if they are to better serve the people. There must be a conscious intelligence at work, with a clearly-defined goal and a determined will to see the job through. What is needed, in short, is a comprehensive plan for Burma's economic development. Only through such a program for economic development can this great challenge be answered.

2. FEATURES OF THE ECONOMIC DEVELOPMENT PROGRAM. The plan for economic development must encompass a survey and appraisal of the resources of Burma; the setting of feasible goals for the country as a whole and for fields of activity on a balanced basis; the economic policies which are essential to achieving the goals; and a blueprint of the administrative apparatus and procedures of Government adapted to assure the effective execution of the program.

The basic resources of a country obviously include its people, agricultural land, minerals, water and forests. Less clear are the uses to which these resources can best be put. More is required for the development of a country than a mere listing of its resources. There are questions as to accessibility and adaptability which need analysis. The cost and yields, in a broad sense, of resource use need to be weighed and compared. Above all, the relations of resources, each to the other, must be studied intensively, if the plan for their useful exploitation is to be meaningful and practicable.

Ambitious yet feasible production goals are needed as the framework of any plan of work or action. Not only must Burma's economic development objectives be realistically related to her manpower and material resources and to the markets available for her output, but they must take into full account the wants of her people, her national customs and beliefs, and her political and social ideals. This means the production goals must take into account the welfare implications of how and for what the resources are used. Likewise, the goals for various industries must be consistent and balanced. The objectives in each industry, as well as each project, must be realistically related to all other economic activities on which it depends and which in turn depend on it.

Government economic policies can facilitate or retard the development of the country. Appropriate policies must be formulated with respect to taxation, expenditures, direct Government investment, foreign trade, credit expansion and similar matters which are more or less within the province of Government. There must be synthesis between the material flows of resources and the financial mechanisms of the economy if maximum results are to be forthcoming. The Government's policies must be designed to aid these flows in relation to the goals.

This Preliminary Report is not intended to satisfy all of these characteristics or requirements of a comprehensive plan for the economic development of Burma. Much more intensive study and investigation will be required before many of the basic issues outlined above can be intelligently resolved. Only what is reasonably clear is proposed for action in this report. It provides the basic framework of the over-all plan, indicates important first steps to be taken, and outlines the further studies essential to the comprehensive development program.

3. MAJOR REQUIREMENTS OF THE ECONOMIC DEVELOPMENT PROGRAM. Granted the natural wealth and the manpower resources of Burma, the major requirements for the successful execution of a program for economic development are: the availability of capital, the availability of skilled workers, technicians and managers, and internal peace and security.

Without question, the capital requirements for a major program of economic development will be extremely large in relation to present Burmese financial resources, especially if rapid progress in raising production and living standards is sought. While the Burmese economy will be able to supply a large part of the capital required, it is clear that much of the necessary capital will have to be met by loans and investments from abroad. With respect to both foreign and domestic capital, the question arises as to what degree the capital required should be supplied from private or public sources. Private capital will only be forthcoming voluntarily on certain terms, which involve considerations of safety of the capital, the prospects of adequate returns, and, with respect to foreign capital, the convertibility of the returns into foreign exchange. Public domestic capital formation will be dependent on the Government's fiscal policies—the types and amounts of taxes levied, the amounts devoted to current and capital expenditure, credit expansion, and the general relationship of Government outlays to Government receipts. Public capital from abroad will also be dependent in large degree on the nature of the policies and programs the Burmese Government adopts. This Preliminary Report will indicate, in so far as is possible at this time, the nature of the problems which will be encountered in obtaining the domestic capital necessary for the economic development program, the policy choices involved, and some specific proposals for the accumulation and use of local capital.

A shortage of skilled workers, supervisors, technicians, administrators and executives is bound to become a sig-

nificant limiting factor in the early stages of any ambitious program of economic development. Unless well-planned and vigorous measures are taken at the very outset to train personnel for these key positions, such shortages would soon become a real bottleneck in the way of further progress. The program must therefore evaluate at the outset the needs which will be generated for personnel of various skills, abilities and experience, and provide formal and on-the-job training programs to prepare people for these essential tasks. Real study is needed to project forecasts of such personnel needs and to evaluate the types of training—vocational schools, professional and technical schools, in-service training, schools for public administration, sending of persons abroad, hiring of foreign technicians and teachers,—which will best meet those needs in time. To the extent possible, this Preliminary Report will indicate the nature and scope of those needs, and recommend the actions and the further study required.

Such economic progress as can be achieved in spite of insurrection and dacoity will undoubtedly contribute towards pacification and internal peace. At the same time, it must be recognized that if Burma is to make rapid and sizable progress towards achieving greater output and improved levels of living and welfare for her people, it is essential that internal peace and order be restored. Insurrection and civil unrest on a wide scale will make any large measure of economic progress impossible.

Internal disorder diverts the energies of a people from productive to destructive pursuits. Not only does it prevent constructive action to improve social capital; it destroys that which already exists, and drives living levels down for the great mass of people. It diverts men, money, and materials from positive employments. It throttles incentives to work, to save, and to invest in socially-enriching ventures. It hampers that production which has already been undertaken by disrupting the flow of materials to the site of production and the flow of the products to the user. It restricts the flow of exports and the distribution of imports. By curtailing Burma's foreign trade and consequent supply of foreign exchange, it limits the purchase of vitally-needed consumption goods and productive equipment.

In short, no plan for the economic development of Burma can fully succeed—no matter how well thought out, no matter how able the administrators—until internal peace and order are effectively restored.

4. ECONOMIC DEVELOPMENT GOALS. Insofar as is possible at this time, interim economic development goals are being proposed for Burma in reasonably specific terms—for selected specific projects in new industries; for the first steps in the modernization and expansion of the nation's power, transportation and communication facilities. Where feasible, tentative development goals are stated in terms of specific agricultural and industrial output; of employment, levels of living, capital investment, and the like.

It is important that the program be expressed quantitatively in terms of the gross national product at which it aims. Tentative judgments as to Burma's total production potential are necessary to ensure that development goals will not aim at less than is reasonably attainable, nor call for more resources in manpower, materials, capital and technology than can be made available to meet requirements. It is essential to strike a balance between ambition on the one hand and feasibility on the other. This raises the major question as to what extent Burma's total output of goods and services—her gross national product—can be made to expand within a given period of time, say within a decade.

Certain assumptions must be made as a basis for setting goals. One of the most important premises relates to internal security. Some arbitrary assumption as to when internal peace will be restored is necessary if economic projections are to be made. For the purposes of this projection, it is assumed that civil order will be fully established by the beginning of 1954 and that peace will prevail thereafter. This means the virtual stoppage of the insurrection within two years. To the extent that peace comes more quickly, the progress will be more rapid. Conversely, persistence of disorder will further delay progress.

Another premise relates to the reasonably prompt implementation by the Government of the Union of Burma of the constructive policies and action essential for economic development. It is assumed that the expansionary features of the Government's 1951-52 budget will be carried out to the fullest possible extent; also that the principal recommendations of this report will receive early attention and action. The policies and projects suggested may not all be fully feasible until greater internal security is established, but those which can be initiated under existing circumstances should be undertaken without unnecessary delay. It is assumed that as this survey proceeds, additional projects and basic policies which will be recommended will likewise be implemented. Especially important is the assumption that government policies will seek to direct the maximum feasible portion of current production into capital facilities. It is also anticipated that substantial funds for financing the program may be forthcoming from external sources.

At the start of 1952, the output of goods and services in Burma was at an annual rate of some Rs. 3,000 to 3,500 million (300 to 350 crores). This is about 40 per cent below total output in 1938-39, which amounted to some Rs. 5,000 to 5,500 million (500 to 550 crores)

at present prices. Projections of goals will be presented in prices prevailing at the beginning of 1952, so that comparisons may be made with current levels of the gross national product of Burma.

By the beginning of 1954, when, it is assumed, civil order has been fully restored, the goal for total production of the economy of Burma should be an annual rate of at least Rs. 4,000 million (400 crores). This would represent an increase of nearly 25 per cent from present levels and should be feasible with steady improvement in internal peaceful conditions.

Within two to three years after the end of the insurrection, the goal for total output should be a level of Rs. 5,500 million (550 crores), at or slightly above the total production which prevailed immediately prior to World War II. A gross national product of this magnitude for the year 1956 would represent a two-thirds increase over present levels. It would not only clearly bring a substantial increase in the living standards of the people of Burma, but would also permit a more rapid rate of capital accumulation.

By 1959 the goal for total production should be a level of Rs. 7,000 million (700 crores) per year, which is more than double the present level, and which would exceed the per capita income of the immediate pre-World War II years, at the presently anticipated rate of population increase. Thus, within a period of eight years, six of them free of civil disorder, Burma should be capable of more than doubling her rate of production and of laying a sound basis for further rapid and substantial economic progress.

It is necessary to have some indication of the total investment which will be needed for the fulfillment of these developed goals. Substantial investments will be required, both to reconstruct and rehabilitate the productive capacity destroyed or damaged by war and insurrection and to add to the prewar stock of capital equipment to support the expansion of total production to new high levels. It is tentatively estimated that the schedule of economic development outlined above will call for the total investment of approximately Rs. 7,500 million (750 crores) in terms of present prices.

A reasonably persistent relationship has been observed in many countries between total investments and given increases in total production. Obviously, the relationship between investment and the resulting increase in production varies from one industry to another. However, a comprehensive program of development encompasses the coordinated development of many industries and public utilities and public works. It is the over-all economy of a country for which the investment-production relationships have been found to be so persistent. A brief study of the major areas of economic activity in Burma confirms the reasonableness of the above estimate of total investment requirements. On the basis of these considerations plus evidence of past relationships within Burma, the level appears to be sufficiently reasonable to serve for the time being as a working measure of total investment requirements. It will be necessary to adjust this preliminary total by developing estimates for each major field of activity, including Government operations. This will be an important aspect of the continuing work of the survey group.

Approximately two-thirds of these investment needs can be financed internally, provided that one-eighth of the total output of the country is saved for new investment. The fraction of income saved is now lower; as income rises, steps must be taken to increase savings more than proportionately. Probably one-third of the total investment needs of the economic development program will require external financing.

It is stressed that these are suggested as tentative goals. They are based on an over-all preliminary appraisal, which is believed to be reasonably conservative, and are certainly subject to review and revision as the survey group explores more fully the resources of Burma and evolves a more comprehensive program for the most efficient and maximum utilization of these resources. It is believed that these goals are not only entirely feasible, but that an all-out effort toward the introduction and application of modern techniques, especially in rice culture, might result in exceeding them to a worthwhile degree. For the present, they should serve as moderately ambitious and certainly attainable objectives.

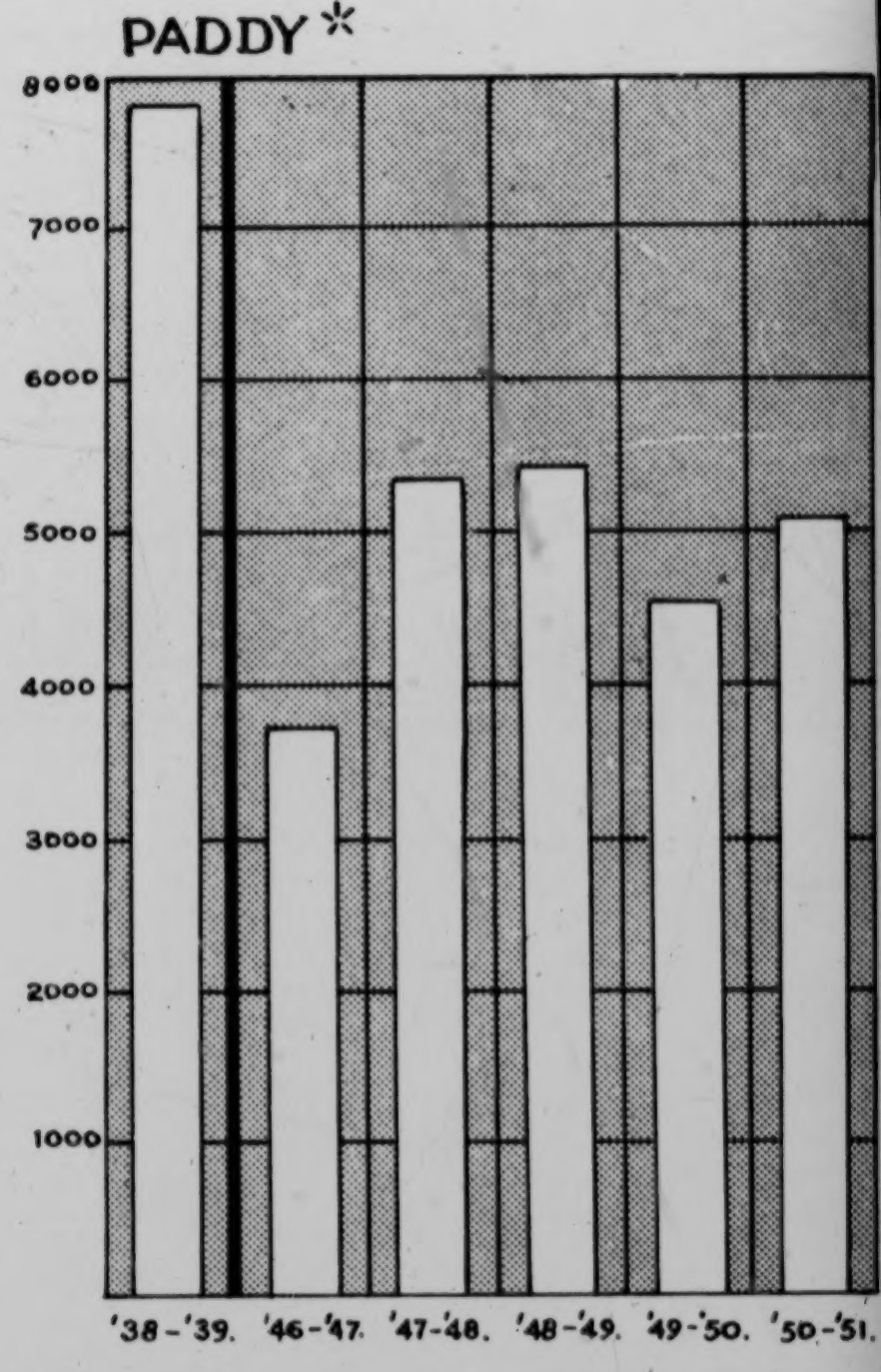
AGRICULTURAL PRODUCTION

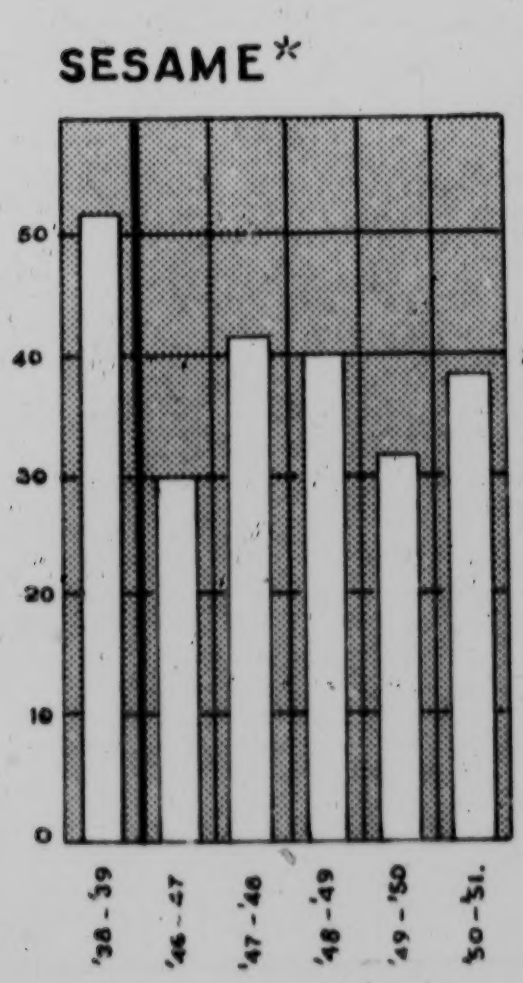
ကောက်ပဲသီးနှံ အထွက်

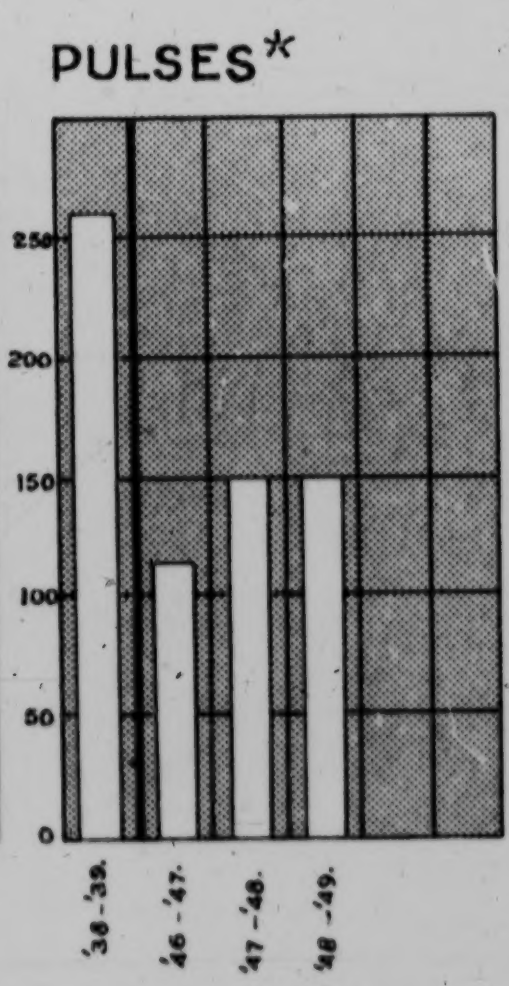
THOUSANDS OF TONS—*

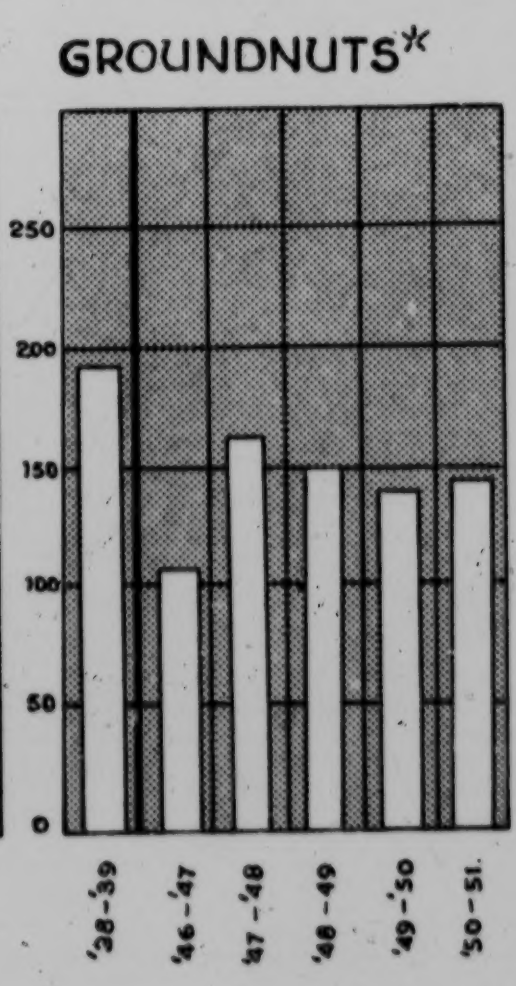
THOUSANDS OF CANES—°

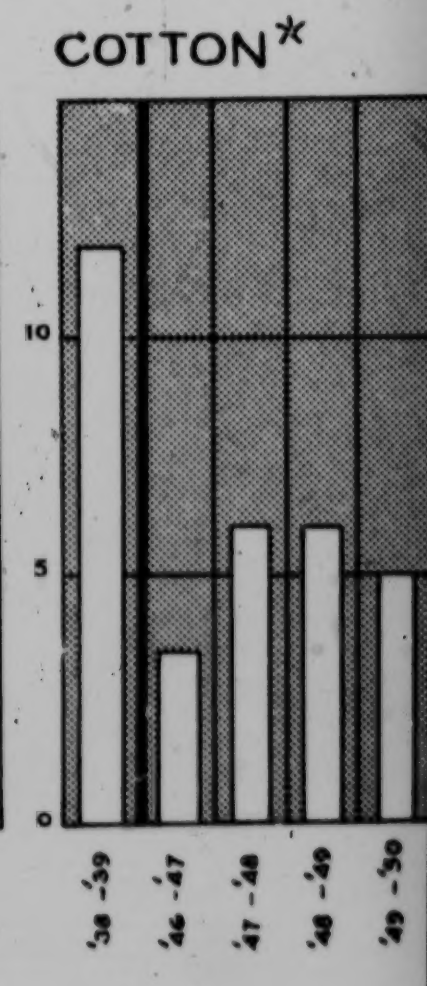
SOURCE: Ministry of National Planning









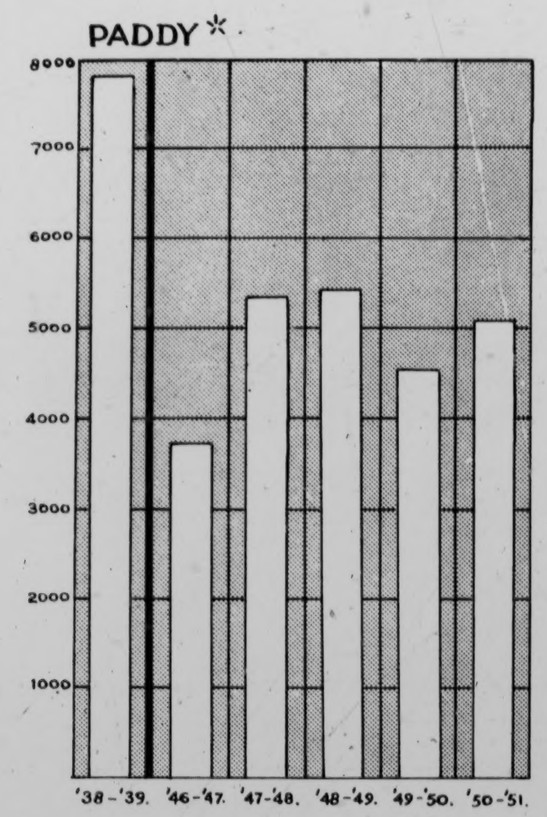


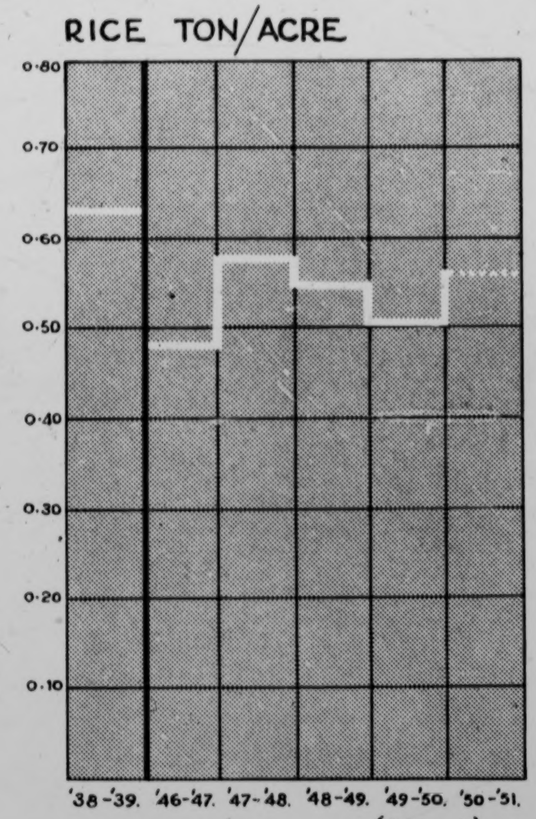
JLTURAL
JCTION

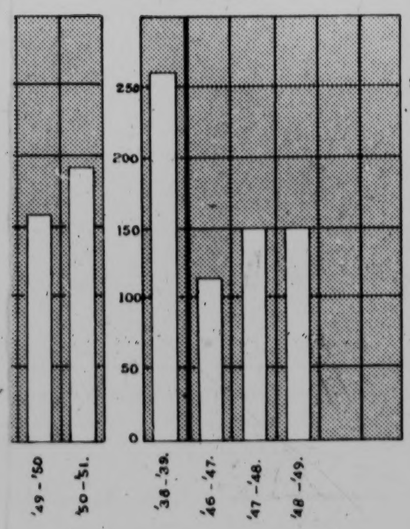
OF TONS—*

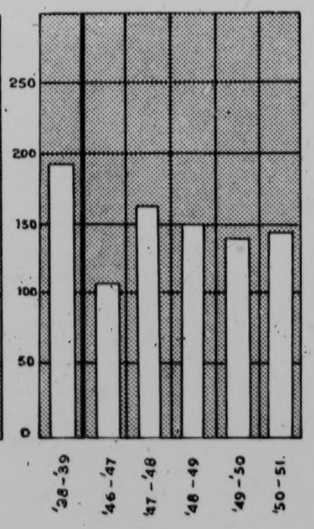
OF CANES—°

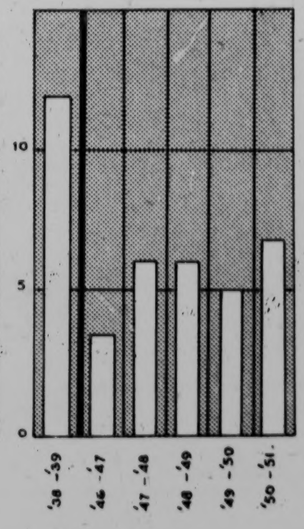
ry of National Planning

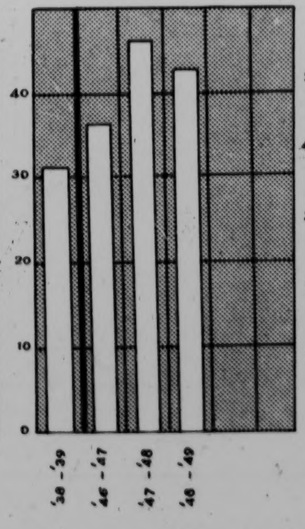


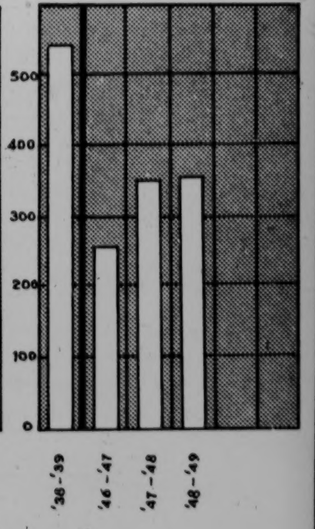






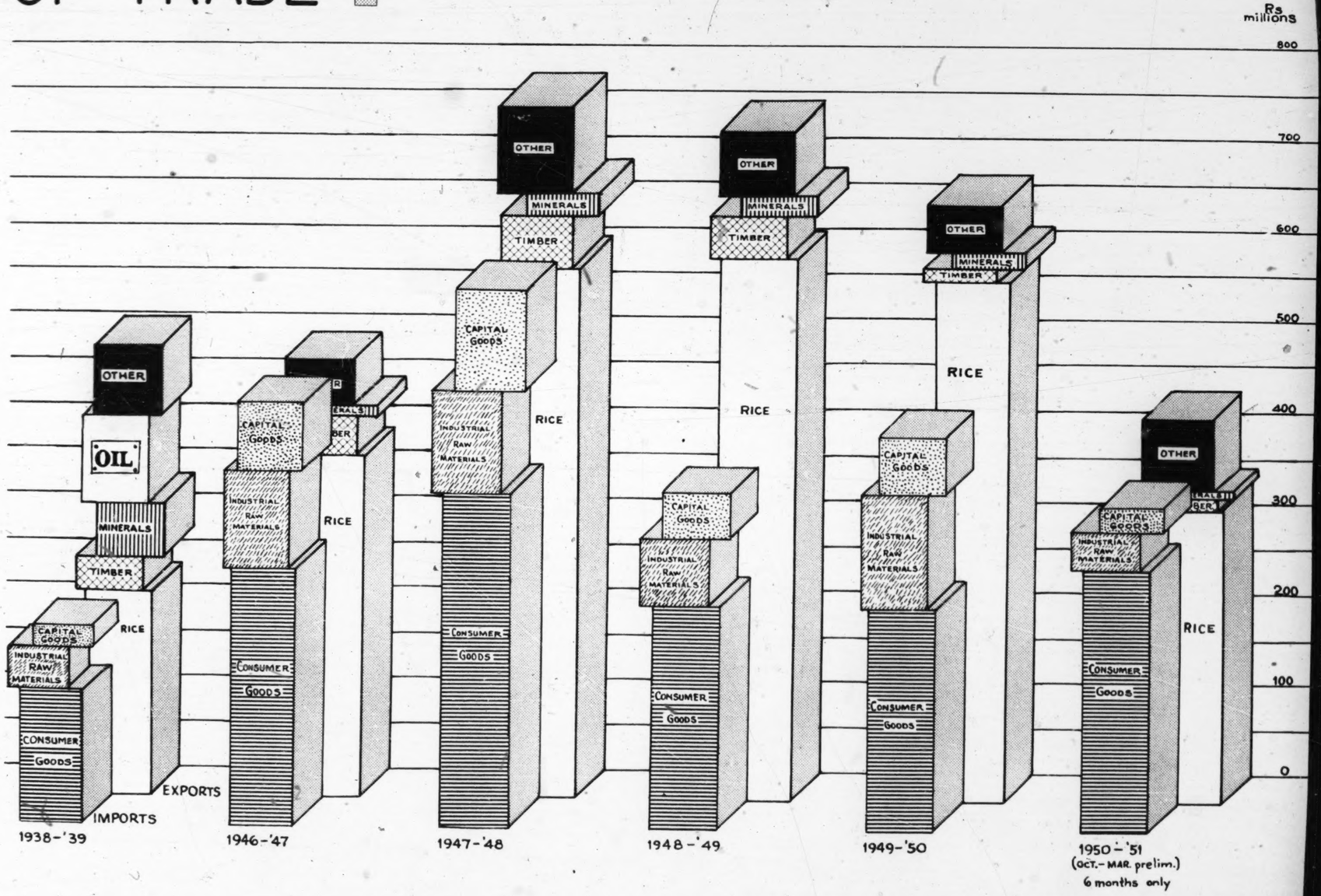






BALANCE OF TRADE

ကုန်ရောင်းဝယ်ရေးနှိုင်းဆချက်



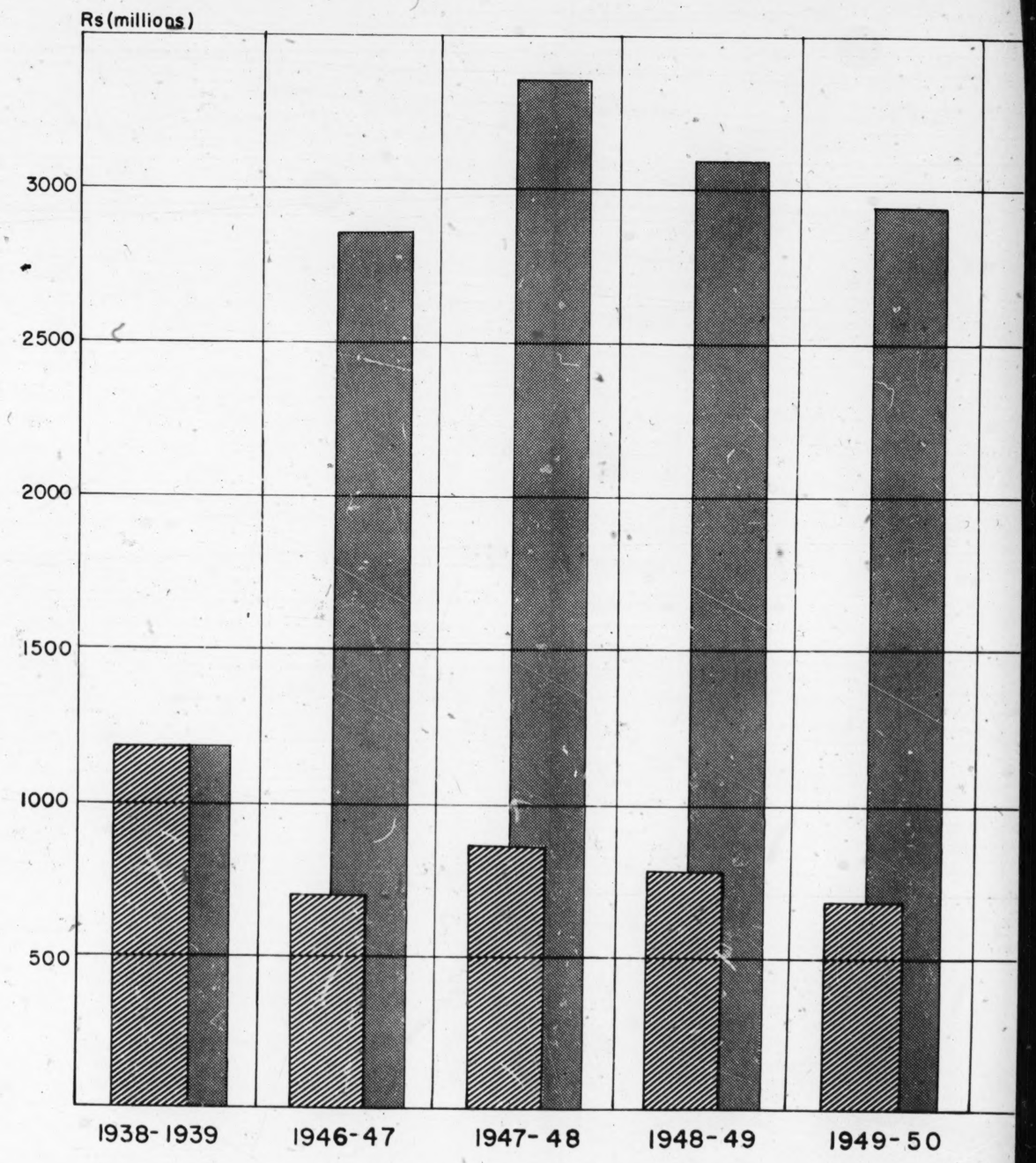
Source = Ministry of National Planning

GROSS NATIONAL PRODUCT

CURRENT RUPEES

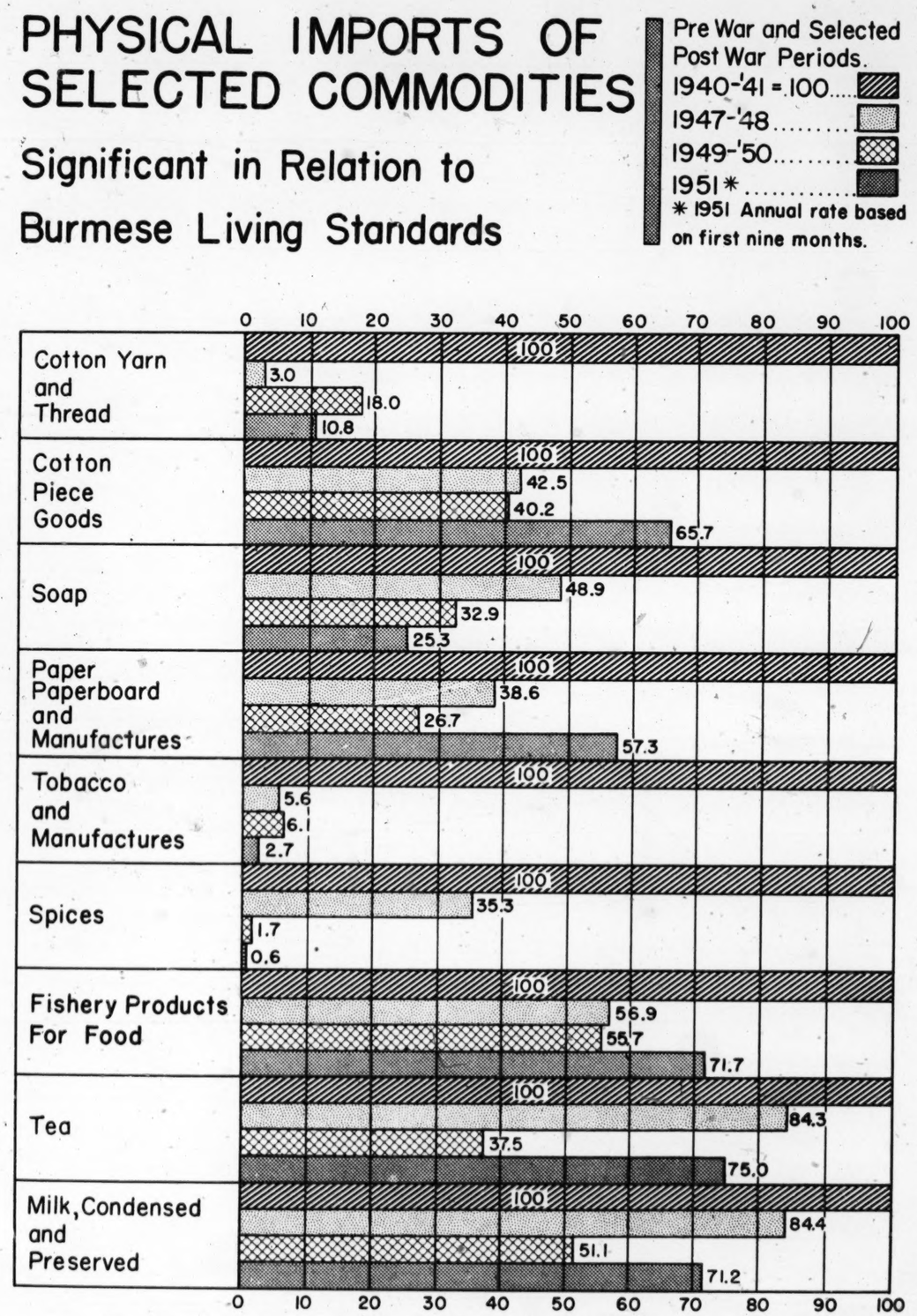
1938-1939 RUPEES

ပြည်တွင်းထုတ်ကုန်
တန်ဘိုးငွေပေါင်း



PHYSICAL IMPORTS OF SELECTED COMMODITIES

Significant in Relation to Burmese Living Standards



COMPOSITION OF GROSS NATIONAL PRODUCT

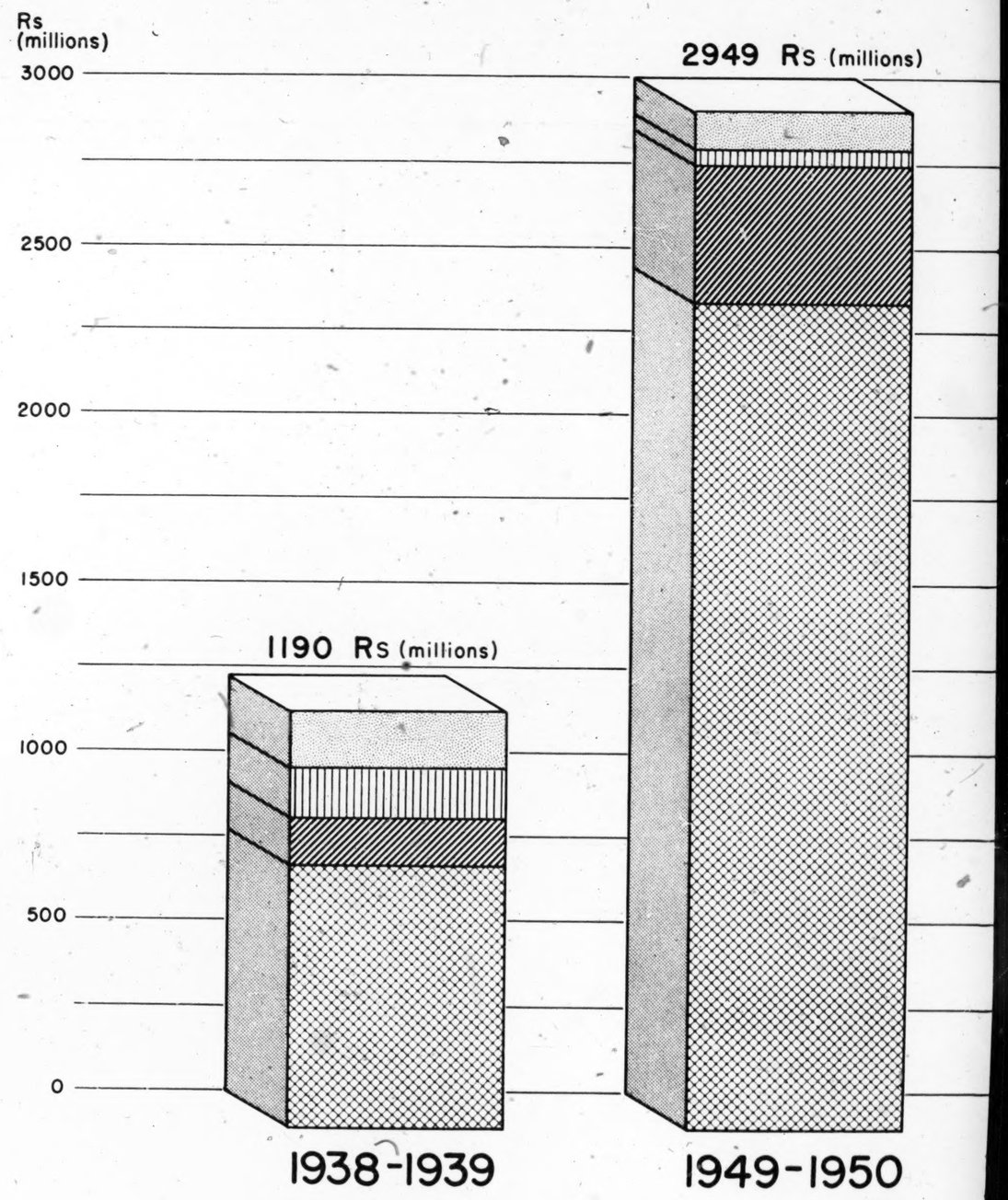
NET FOREIGN INVESTMENT

GROSS DOMESTIC CAPITAL FORMATION

GOVERNMENT PURCHASES

PRIVATE CONSUMPTION

ပြည်ဝင်း: ထုတ်ကုန်သုံးစွဲပုံ



SOURCE: Ministry of National Planning

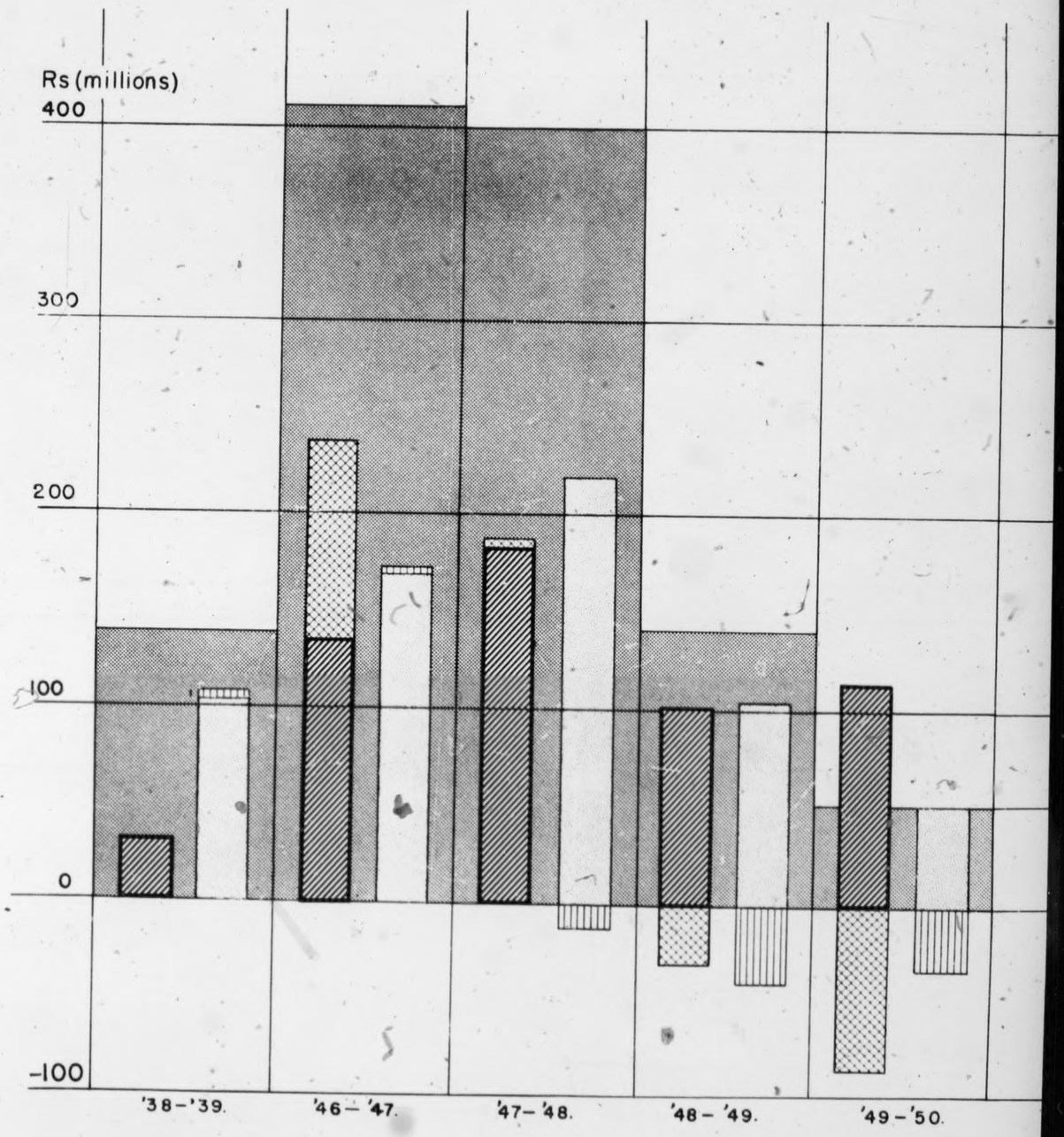
DOMESTIC CAPITAL FORMATION (GROSS)

ပြည်တွင်းအရင်းမတည်ငွေပေါင်း

PUBLIC
- Fixed Capital
- Changes in Stock

PRIVATE
- Fixed Capital
- Changes in Stock

TOTAL



SOURCE: Ministry of National Planning

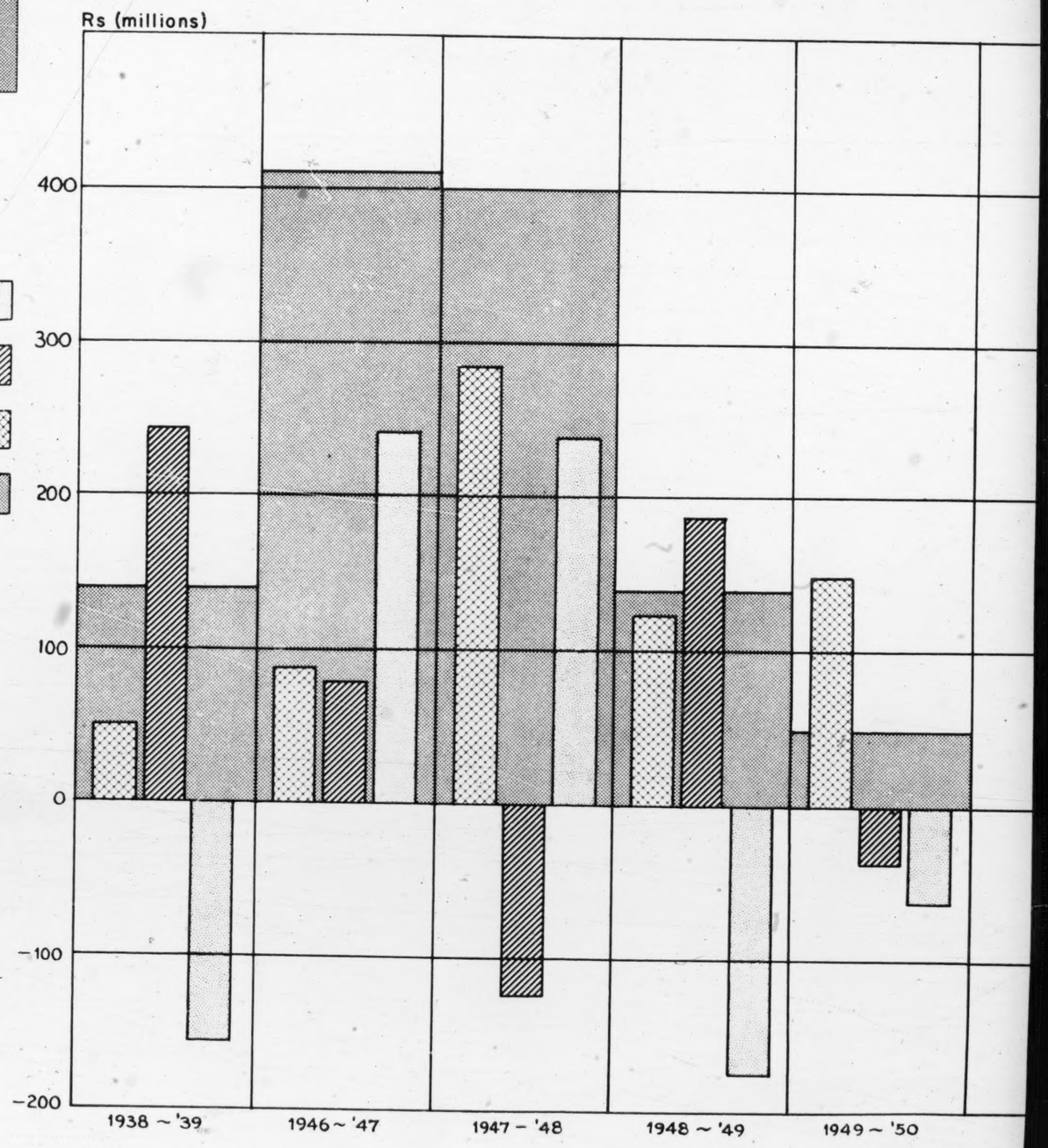
SOURCES OF INVESTMENT

NET BORROWING FROM ABROAD

PRIVATE SAVING

PUBLIC SAVING

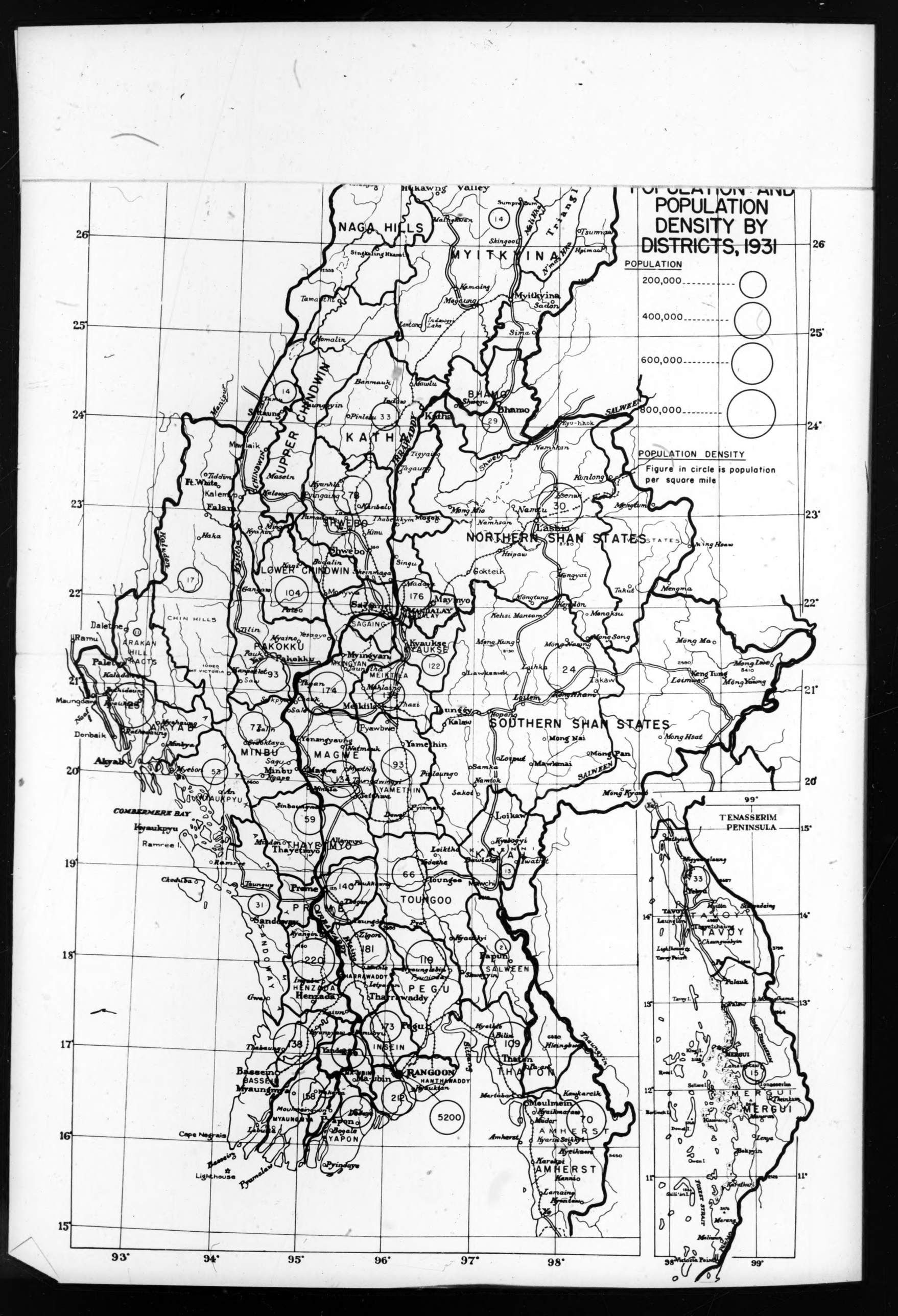
TOTAL (NET)



ဖြူပ်နှံသည့်ငွေရင်း
ရရှိရာ

SOURCE: Ministry of National Planning

BURMA
POPULATION AND POPULATION DENSITY BY DISTRICTS, 1931
POPULATION
200,000
400,000
600,000
800,000
POPULATION DENSITY
Figure in circle is population per square mile
NAGA HILLS
Hukawng Valley
MYITKYINA
Triangle
BHAMO
KATHA
UPPER CHINDWIN
LOWER CHINDWIN
SHWEBO
MONYWA
SAGAING
MANDALAY
MEIKTILA
YAMETHIN
PAKOKKU
MINBU
MAGWE
THAYETMYO
PROME
TOUNGOO
NORTHERN SHAN STATES
SOUTHERN SHAN STATES
KYAUKSE
CHIN HILLS
ARAKAN HILL TRACTS
AKYAB
SALWEEN
COMMERMERE BAY
TENASSERIM PENINSULA
TAVOY
92°
93°
94°
95°
96°
97°
99°
100°
101°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
15°
14°


POPULATION AND
POPULATION
DENSITY BY
DISTRICTS, 1931
POPULATION
200,000
400,000
600,000
800,000
POPULATION DENSITY
Figure in circle is population
per square mile
NAGA HILLS
MYITKYINA
BHAMO
KATHA
UPPER CHINDWIN
LOWER CHINDWIN
SHWEBO
SAGAING
MONYWA
CHIN HILLS
ARAKAN HILL TRACTS
PAKOKKU
MINBU
MAGWE
YAMETHIN
THAYETMYO
PROME
TOUNGOO
PEGU
INSEIN
RANGOON
HANTHAWADDY
THATON
AMHERST
MERGUI
TAVOY
TENASSERIM PENINSULA
NORTHERN SHAN STATES
SOUTHERN SHAN STATES
KAYAH
SALWEEN
COMBERMERE BAY
Cape Negrais
Light-house
Victoria Point
TRIBUTARY STATES
99°
98°
97°
96°
95°
94°
93°
26°
25°
24°
23°
22°
21°
20°
19°
18°
17°
16°
15°
14°
13°
12°
11°

Section II

THE PEOPLE OF BURMA AND THEIR WELFARE

A. SIZE AND STRUCTURE OF THE POPULATION AND LABOR FORCE.

A country's total production is limited by the number of workers it can put to work and the output per worker. In turn, total production is the principal factor in determining the standard of living of the people of a country. Hence the size of the present and future labor force and population of Burma, and factors like education and health which affect their productivity, are of basic importance in arriving at recommendations for Burma's economic development.

1. SIZE OF THE POPULATION. There has been no census in Burma since the war. Therefore the size of the present population and labor force must be estimated from prewar data. The most recent labor force data are those for 1931, since such statistics from the 1941 census did not survive the Japanese invasion. Table I presents population data by administrative divisions.

The population figures of the last four decennial censuses are:

Year	*Population*	*Present Increase Each Decade*
1911	12,115,217	
1921	13,212,192	9%
1931	14,667,146	11%
1941	16,823,798	15%

Since the geographic coverage of successive censuses increased, the figures overstate the increase in population in the area now covered. The 1931-1941 increase in the present area was in reality 14 per cent rather than 15 per cent. The increase was due to excess of births over deaths, since net immigration during this decade was nil.

The percentage increase between 1941 and 1951 was undoubtedly smaller than in the preceding decade. The war caused some increase in the death rate. The disturbed conditions during and after the war probably lessened the birth rate. Further, some 500,000 persons fled to India during the war, of whom perhaps nearly half have not returned. For these reasons the population at present may be only some 10% greater than in 1941—or about 18.5 million.

If a national health program is successful, a considerable lowering of the death rate, especially the infant mortality rate, may be expected. Past experience in other countries indicates that a declining birth rate lags considerably behind a drop in infant mortality. Hence, the rate of increase in population in the next couple of decades or more will probably be larger than 14 per cent per decade—a factor of importance in judging future economic trends.

TABLE I

SELECTED POPULATION DATA, 1931 AND 1941

A. *Geographic Distribution*

Division or State	*Population in* 1931	*Population in* 1941	*Per Cent Change* 1931 to 1941	*Per Cent of Division to Total in* 1941
Arakan	1,008,535	1,186,738	17.66	7.1
Pegu	2,549,637	2,961,249	16.14	17.6
Irrawaddy	2,334,774	2,659,126	13.89	15.8
Tenasserim	1,872,668	2,110,420	12.69	12.6
Magwe	1,722,044	1,905,809	10.67	11.3
Mandalay	1,696,332	1,907,703	12.46	11.3
Sagaing	1,918,058	2,322,675	21.09	13.8
Eastern States	1,565,098	1,770,078	13.09	10.5
Total Burma	14,667,146	16,823,798	14.70	100.0

B. *Males and Females by Divisions,* 1941

Division or State	*Males*	*Females*	*Per Cent Males*	*Per Cent Females*
Arakan	619,845	566,893	52.2	47.8
Pegu	1,570,695	1,390,554	53.0	47.0
Irrawaddy	1,357,386	1,301,740	51.0	49.0
Tenasserim	1,090,301	1,020,119	51.7	48.3
Magwe	940,448	965,361	49.3	50.7
Mandalay	949,808	957,895	49.8	50.2
Sagaing	1,136,188	1,186,487	49.0	51.0
Eastern States	910,899	859,179	51.5	48.5
Total Burma	8,575,570	8,248,228	51.0	49.0

Source: 1941 Census.

2. GEOGRAPHIC DISTRIBUTION OF THE POPULATION. As the map at the end of this section indicates, the population of Burma is predominantly rural, and is concentrated in the delta and in the dry zone. The map shows the degree of concentration in these two areas, with lesser concentrations between and around them, and near Akyab and Moulmein. In the rest of the country the density is below 50 per square mile, and ranges down to 10.

The distribution of population in Burma in 1931 is shown by village tract or community in Table II. Only 31 communities had populations exceeding 10,000. These accounted only for some 1.1 million people, or about 7.5 per cent of the population. Some 69 towns with populations between 5,000 - 10,000 accounted for another half-million, or an additional 3.2 per cent of the population. Below this level, Burma is largely a land of small villages interspersed with towns of a few thousand inhabitants each. About one-fifth of the population lived in village tracts with populations under 500; somewhat more than a fifth in tracts or communities between 500 - 1,000, and almost a third in communities between 1,000 - 2,000. Almost 90 per cent of the population resided on farms and in villages and towns with populations of 5,000 or less.

TABLE II

DISTRIBUTION OF POPULATION IN BURMA, 1931 BY SIZE OF COMMUNITY

Population of Towns or village tract	*Number of communities in size group*	*Population in size group*	*Per Cent of population in size group*
under 1,000	28,238	6,260,196	42.8
1,000 - 2,000	3,333	4,534,194	31.0
2,000 - 5,000	808	2,200,954	15.0
5,000 - 10,000	69	466,578	3.2
10,000 - 20,000	17	221,284	1.5
20,000 - 50,000	11	295,216	2.0
50,000 - 100,000	1	63,454	.4
100,000 and over	2	515,311	3.5
Totals	32,479	14,647,497 [1]	100. [1]

[1] 90,310 persons separately classified under "encampments, boat and railway" population are included in the totals, but do not appear in the distribution above.

Source: 1931 Census, Part II, Imperial Table III, pages 10-11.

Some shift of population has taken place since 1941 due to both war and insurrection. In consequence of the latter, people have sought refuge and security in the towns, and, although it is impossible to categorize the magnitude of the shift quantitatively, all observers agree that there has been a considerable increase in the population of the cities and even of the larger villages throughout Burma. Rangoon is an example. The pre-war population of half a million had swelled to 613,000 by January 1950, and the number of refugees has increased since then. This flight to the towns, much of which will not be reversed, even after pacification, helps to explain (along with capital destruction and economic disorganization) the serious housing shortages and the high rates of communicable disease and infant mortality in the towns.

3. RACIAL DISTRIBUTION OF THE POPULATION. The main non-indigenous racial strain in Burma is Indian (including Pakistani). The Indian population in 1931 was more than a million—7 per cent of the total. In 1941 it was somewhat smaller, both absolutely and relatively. At least half of the Indians evacuated Burma prior to the Japanese occupation and probably less than 300,000 have returned. Further, due to recent restrictions on immigration and the gradual return of many migrants to their homeland, and because the reproduction rate of Indians is far below the national average, the number of Indians today is probably less than 4 per cent of the population, and is declining.

Next in order of importance are the Chinese and Indo-Burmans, who numbered 194,000 and 112,000, respectively, in 1931. They have probably increased less percentagewise than the population as a whole in the past two decades.

4. SIZE OF THE LABOR FORCE. It seems probable that about 45 per cent of the population was in the labor force in 1931, and that the percentage has not changed greatly since that time. Although the 1931 census indicates a labor force equal to 42.4 per cent of the population, the method of tabulation was such as to understate the number of working dependents. There were probably about 8 million persons in the labor force in 1951.

The percentage of the population in the labor force will probably not increase in the future. Because of high birth rates and death rates, a very high proportion of the population of Burma—37 per cent—consists of children under 15 years of age (See Table III). In western countries, the corresponding percentage is between 24 and 30.

TABLE III

AGE AND SEX DISTRIBUTION OF 1931 POPULATION

Age	*Absolute Numbers*			*Per Cent of Total*		
	Total	*Males*	*Females*	*Total*	*Males*	*Females*
0 - 5	2,018,253	990,120	1,028,133	13.8	13.2	14.3
5 - 10	1,800,962	908,410	892,552	12.3	12.2	12.5
10 - 15	1,661,007	845,623	815,384	11.3	11.3	11.4
15 - 20	1,412,615	693,377	719,238	9.6	9.3	10.0
20 - 30	2,712,514	1,382,778	1,329,736	18.5	18.5	18.6
30 - 40	2,029,038	1,101,814	927,224	13.8	14.7	12.9
40 - 50	1,357,050	719,797	637,253	9.2	9.6	8.9
50 - 60	912,291	466,695	445,596	6.2	6.2	6.2
60 - 70	510,854	261,549	249,305	3.6	3.5	3.5
70 and Over	232,913	110,513	122,400	1.6	1.5	1.7
Total	14,647,497	7,480,676	7,166,821	100.0	100.0	100.0

Source: 1931 Census, Part II, page 54.

A decrease in death rates would preserve the lives of more children and adults. The decrease in infant mortality would tend to lower the proportion of population in the labor force. However, a lower death rate for adults, because of the present short span of life in Burma, would add to the labor force. A larger number of young people may be expected to prolong their education and training and enter the labor force at a later age; and the foreign-born, primarily Indian males of working age—will decline as a per cent of the population. These factors will tend to counter balance one another. For the next decade or two no sizeable change in the ratio of labor force to population is likely to occur.

5. WOMEN IN THE LABOR FORCE. About 32 per cent of the female population of Burma—the equivalent of almost 3 million female workers in 1951—were in the labor force in 1931.

Table IV shows the occupational break-down of women in 1931. Although 20 years have elapsed, the more significant facts, such as the predominance of women in spinning and weaving, pottery and other handicrafts, and in the trade in food-stuffs, undoubtedly still hold true.

TABLE IV

FEMALE PARTICIPATION IN THE LABOR FORCE IN BURMA IN 1931 BY SELECTED OCCUPATIONAL GROUPS

Occupations	*Total Earners Including Working Dependents*	*Female Earners Including Working Dependents*	*Female Workers as Per Cent of Total*
ALL OCCUPATIONS	6,211,037	1,959,266	31.5
Exploitation of Animals and Vegetation	4,321,356	1,243,839	28.8
Ordinary Cultivation	4,009,135	1,164,300	29.0
Non-cultivating proprietors	70,212	31,367	44.7
Cultivating Owners	1,247,836	320,926	25.7
Tenant Cultivators	749,716	172,168	23.0
Agricultural Laborers	1,488,330	480,967	32.3
Cultivators of Taungya	449,215	158,856	35.4
Cultivation of Fruit, Betel Vine, Rubber, Tea, Sugar, etc.	118,637	41,069	34.6
All Others	193,584	38,470	19.9
Exploitation of Minerals	39,505	3,312	7.9
Industry	664,376	354,977	53.4
Cotton and Silk Spinning, Weaving and Sizing	229,791	221,265	96.3
Workers in Lacquer, baskets and other woody materials	44,485	24,894	56.0
Potters and makers of Earthenware	10,806	7,870	72.8
Food and Tobacco Industries	141,507	61,609	43.5
Articles of Dress, Washing, Cleaning, Hair-dressing, etc.	76,338	29,309	38.4
All Others	161,449	10,030	6.2
Transport and Communication	222,055	12,671	5.7
Trade	557,248	291,079	52.2
Public Force	30,816	4	.0
Public Administration	44,867	388	.9
Professions and Liberal Arts	198,890	23,166	11.6
Domestic Service	44,689	10,088	22.6
Unproductive and Insufficiently Described	87,235	19,922	22.8

Source: 1931 Census, Part II; Imperial Table X, Part I, pp.105-111.

It should be noted that many more women than men were engaged in occupations in which part-time employment was widespread. Further, concentrations of women workers are found in occupations of typically low productivity, such as petty trading, personal services and handicrafts. Shifts to more productive occupations and, in addition, steadier employment, would be particularly effective in increasing the output per worker of female workers. This is especially possible in towns, where continuity of employment is not so dependent on seasonal patterns and task around the home are not so demanding. Opportunities for a shift in the occupations filled by women and some increase in the regularity of their employment should occur as the development program unfolds. This will contribute to raising living standards.

6. VARIOUS RACIAL GROUPS IN THE LABOR FORCE. In the past, non-indigenous races have had an importance in the economic life of Burma out of all proportion to their numbers. Table V, which indicates the distribution of male earners in selected economic functions in 1931 by race, shows the disproportionate importance of Indians (with only 14 per cent of the male labor force) as unskilled and semi-skilled laborers, traders and shop assistants, clerical workers, craftsmen, managers, and in the armed forces and police. The participation of Burmans in the economic activities of the nation was less than proportionate to their numbers most markedly in the fields of unskilled and semi-skilled labor, clerical work and trade. This situation has changed radically, both because of external circumstances and because of a governmental policy of encouraging Burmans to participate more fully in the various branches of the country's economy.

However, the past has left its mark in that Burmans have not had the opportunity of obtaining the necessary experience as participants, and, in particular as leaders, in the more advanced industrial and commercial sectors. This has intensified the already difficult problem of training. The following income figures for Rangoon, where the country's trade and industry is concentrated, indicate that the economic position of the Burman is still relatively lower.

Median Monthly Income of Households by Race of the Head of the Household

Rangoon, January, 1950

	Median Income in Rs.
All races	165
Mixtures of Burmans with foreign races	255
Chinese	181
Indian and Pakistani	169
Burman races	157

The figure for other foreign races was not published because of the smallness of the sample. Undoubtedly it exceeds all others.

TABLE V

PER CENT DISTRIBUTION BY RACE OF MALE EARNERS GROUPED BY SELECTED ECONOMIC FUNCTIONS, 1931

	Number of Workers— All Races	*Total Per Cent*	*Burmans Proper*	*Other Indigenous Races*	*Indians Born Outside Burma*	*Indians Born in Burma*	*Chinese*	*Other Races*
All Male Earners*	3,778,336	100	53.3	29.2	12.1	1.9	2.1	1.3
Selected Economic Functions:								
Cultivating Landowners	1,174,584	100	44.6	51.7	1.1	.9	1.1	.6
Cultivating Tenants	535,695	100	68.2	25.0	3.4	2.5	.1	.8
Agricultural Laborers	917,212	100	67.5	23.8	5.1	2.6	.2	.9
Unskilled and Semi-Skilled Laborers (excluding Sweepers and Scavengers)	435,293	100	38.2	9.5	45.4	2.1	3.4	1.5
Sweepers and Scavengers	6,995	100	3.5	.3	90.4	5.5	.2	.2
Traders and Shop Assistants	246,065	100	40.3	9.9	31.0	2.5	13.3	3.1
Craftsmen	191,689	100	56.9	9.7	23.2	2.0	5.9	2.3
Clerical Workers	47,341	100	39.1	8.3	37.9	4.4	4.0	6.5
Rentiers	44,048	100	61.1	27.8	5.2	1.8	1.4	2.7
Army, Navy, Air Force and Police	38,569	100	29.6	20.4	41.1	1.9	.3	6.7
Managers and Officials of Organized Industrial Undertakings	3,347	100	51.3	6.4	17.9	3.6	6.0	14.7

* Excludes Male Working Dependents as well as All Female Earners and Working Dependents.
Source: 1931 Census, Part I, p. 155, and Part II, p. 300.

The higher income position of non-Burmans is undoubtedly due in large part to their occupying positions for which Burmans have not been given the opportunity to develop the necessary "know-how" and experience. In some degree positions occupied by non-Burmans also require longer hours and more strenuous labor.

7. OCCUPATIONAL DISTRIBUTION OF THE LABOR FORCE. The most recent detailed figures of occupational distribution of the labor force are those of the 1931 census. These are summarized in Table VI.

Almost 70 per cent of all workers were engaged in agriculture (66.4 per cent), forestry, animal raising and fishing and hunting. Close to 11 per cent were distributed throughout the field of industry, with the heaviest concentration in textiles (3.7 per cent). A great many of these workers were occupied in home, handicraft and small scale production which did not constitute industrial production in the modern sense of the word. Some 9 per cent of all workers were engaged in trade, mostly in foodstuffs (7.3 per cent). A large part of this was undoubtedly petty trade, as represented by roadside and street vending. Some 3.5 per cent engaged in transport and 3.2 per cent in the profession and liberal arts comprised most of the balance.

The Directorate of Labor is now collecting monthly data on employment in selected enterprises. Due to such factors as communication difficulties and inexperience in reporting, more than half the known establishments have not reported, and the accuracy of those who have reported is subject to verification. For what they may be worth, a summary of the returns for the first six months of 1951 is presented in Table VII. The table shows that 699 firms, out of 1,590 known firms in the fields shown, reported employment figures for both permanent

TABLE VI

DISTRIBUTION OF WORKERS IN BURMA BY MAJOR CENSUS CLASSIFICATION, 1931

Major Census Classification	*Total Number of Workers (In Thousands)*	*Percentage of Workers in Each Group*
Exploitation of Animals and Vegetation	4321.4	69.6
Ordinary Cultivation	4009.4	64.5
Special Crops	118.6	1.9
Forestry	52.7	.9
Animal Raising	79.9	1.3
Fishing and Hunting	61.0	1.0
Exploitation of Minerals	21.9	.3
Exploitation of Petroleum	17.6	.3
Industry (including Cottage Industries)	664.4	10.7
Textiles	233.2	3.7
Sawyers	21.3	.3
Metals	21.6	.3
Ceramics	13.5	.2
Chemical Products	18.5	.3
Rice Processing	63.3	1.1
Other Food Industries	78.2	1.3
Articles of Dress	60.0	1.0
Misc. Construction and Wood Crafts	101.5	1.6
Misc. Industry	53.3	.9
Transport	222.1	3.5
Water Transport	73.7	1.2
Roads and Bridges	35.0	.5
Road Transport	80.5	1.3
Rail Transport	27.8	.4
Other	5.0	.1
Trade	557.2	9.0
Banks, Insurance, Brokerage, etc.	13.2	.2
Textiles	18.8	.3
Wood (excl. Firewood)	14.9	.2
Trade in Food-stuffs (incl. Hotel, etc.)	446.7	7.3
Other Trade	63.8	1.0
Public Administration	49.9	.8
Professions and Liberal Arts	198.9	3.2
Religion	128.3	2.1
Medicines (incl. unregistered healers)	29.1	.5
Instructions	20.7	.3
Arts, Sciences, Entertainment, Astrology, etc.	20.9	.3
Domestic Service	44.7	.7
Miscellaneous	118.1	1.9
Grand Total	6,211.0	100.0

Source: 1931 Census, Part II.

and temporary workers. These firms employed nearly 43,000 permanent workers, and over 48,000 temporary workers, on an average monthly basis from January through June 1951. The largest groups of permanent workers were in the fields of transport, rice milling, saw mills, oil refineries, mining, tobacco products and banking. These accounted for about three-fourths of the total employment shown. The greatest number of temporary workers was found in the fields of rice milling, saw mills, transport and stevedoring. Rice and saw mills alone accounted for about two-thirds of all the temporary employment reported.

TABLE VII

EMPLOYMENT IN SELECTED INDUSTRIES AND OCCUPATIONS

MONTHLY AVERAGES, JANUARY-JUNE, 1951

Industry	*No. of Establishments so far Traced*	*No. of Establishments Making Returns*	*Permanent Workers*	*Temporary Workers* [1]
Transport	23	18	16,991	2,777
Rice Mills	767	319	6,110	27,012
Stores, Companies, Works	138	66	5,370	1,926
Sawmills	134	69	3,160	7,154
Oil Refineries	12	4	1,639	86
Burma Corporation, Ltd.	1	1	1,385	318
Banks	19	15	1,321	110
Cheroot, Cigars, Beedy, etc.	18	11	1,001	311
Railway Workshops	2	1	939	0
Printing and Stationery	38	20	838	120
Match Factories	3	3	662	137
Ice Factories	17	11	504	152
Sugar Factories	3	2	382	519
Theaters	18	10	306	5
Rope and Pottery Works	7	5	278	254
Distilleries	4	4	179	6
Flour Mills	80	32	176	262
Soap Factories	3	2	163	31
Oil Mills	89	22	159	224
Cotton Mills	67	20	145	1,091
Medical Hall, Nursing House & Pharmacy, Clinics & Ayurvedic	13	5	139	2
Dockyards	2	2	122	89
Stevedores	8	5	115	1,661
Metal and Aluminum Foundries and Engineering Work	7	2	100	27
Hosiery and Textiles	6	5	96	27
Film Companies	4	2	77	936
Insurance Companies	23	4	73	256
Leather and Hide Work	7	5	62	1
Chemicals & Beauty Products	6	2	57	21
Dress Makers	9	4	54	1,468
Rubber Plantation & Rubber Works	5	2	39	1
Construction Works & Contractors	4	2	36	325
Confectioneries & Bakers	8	3	28	390
Umbrella Factories	9	7	21	20
Studio, Beauty Parlor and Hair Dressers	3	3	20	271
Glass Works	8	3	13	1
Fodder Mills	3	2	10	38
Pulse Grinding Mills	16	6	3	2
Thanaka Factory	4	—	—	—
Tea Estates	1	—	—	—
	1	—	—	—
Total	1,590	699	42,773	48,031

[1] The figures on temporary workers probably represent the total number of such workers employed during the course of the average month in the period, rather than the full-time equivalent of temporary workers employed.

Source: Directorate of Labour.

B. UTILIZATION OF THE LABOR FORCE.

1. GENERAL. Data which would permit an accurate appraisal of the degree to which Burma's labor force is effectively utilized are virtually non-existent. Pertinent information on this subject would include comprehensive statistics on employment by industry and occupation, hours of work, productivity, seasonality of employment unemployment and the like. In the absence of such information, only general comments can be made.

The labor force in Burma is not utilized to anything approaching its maximum potential contribution to the nation's output and well-being. First, there is considerable unemployment, part-time employment, and under-employment. By under-employment is meant here work situations which do not fully occupy the energies of the people engaged in them, as is the case of petty traders, office peons and the like. Second, since production is carried on to a very large extent with primitive tools, equipment and methods, the workers concerned cannot be productive as would be the case if the work were better organized and better equipment available. Third, inadequate education and training and poor health greatly lessen the effectiveness with which labor can be utilized, even in the present state of technological development in Burma.

Obviously, Burma's labor force must be utilized more effectively, if greater production and increased national well-being are to be achieved. Jobs must be created to absorb the unemployed, to provide better opportunities for the part-time and seasonally unemployed, and to effect a shift of the under-employed from less productive to more productive occupations. More productive tools, equipment and methods of work must be introduced. Better educational preparation and training must be afforded the future worker. Steps must be taken to improve the worker's health and security as well.

Most of these problems are discussed elsewhere in this Preliminary Report. Because of its special importance in Burma's economy and its greater clarity in the current labor picture, a somewhat more extended comment on seasonal unemployment is presented below.

2. SEASONAL UNEMPLOYMENT. Much underutilization of manpower in Burma can be attributed to recurring idleness on a seasonal basis year in and year out. It is a wasteful factor of serious proportions. If every worker were without productive employment for three months of each year, the waste or loss of production

would be the same as if one-fourth of all workers were unemployed all the time.

Seasonal unemployment is insiduous in that the receipt of some income during part of the year tends to obscure its damaging impact upon the worker and the economy, whereas continuous unemployment manifests itself in total loss of income to the worker and is a more shocking phenomenon. The difference between the two, however, is only one of degree. Seasonal idleness directly affects the living standards of those who are without jobs for part of each year, and reduces the total production of the country and thereby the average living level of all its people.

Quantitative measures of seasonal unemployment are generally lacking. But it is clear that roughly two-thirds of the working population is normally occupied in agriculture and most cultivation is seasonal, in varying degrees. Also, the seasonal pattern in various agricultural activities leads to seasonality in derived industries such as the processing of sugar, tea, tobacco and rubber. The important rice milling industry also varies seasonally, even though some processing goes on throughout the year. To some extent the patterns in agriculture are complementary, but the dominant position of rice cultivation results in a major wave of seasonal unemployment. This is especially true of the Delta region where the large production requires many hired laborers and where double-cropping is at a minimum.

The problem of seasonal unemployment is especially burdensome for the employee, although it is also serious for the cultivator himself and his family members who work in the fields. For the farm operator, there is much to be done in the off-season in the way of maintenance and repair work and other activities related to tilling the soil. Still, much of his and his family's time would be available for other employment, provided the opportunities were available. In the case of hired laborers, when their normal employment is terminated, there is at best only the prospect of odd jobs, minor earnings, and, from the social point of view, tremendous waste of manpower.

No doubt some of the migrant workers move from work in the fields to temporary jobs in the rice mills or employment on docks or boats or to public works and miscellaneous casual jobs. The great majority are likely to remain near the homestead because of strong family ties characteristic of the people of Burma. Small-scale weaving, umbrella making, lacquer work, wood cutting and collecting, pottery production and the making of mats, baskets, and other cane, bamboo and leaf products are undertaken by many workers. Output in these activities, largely carried on in the home, is low and the income derived therefrom is small.

Any effective attack on this problem of seasonal unemployment must be predicated on the assembly and analysis of much more data than are now available. The next population census should include questions and tabulations designed to reveal the magnitude of the problem and to provide data on the off-seasonal jobs of agricultural and other workers. Sample surveys should be undertaken at different times of the year in different parts of the country to supplement the census in detail and to reveal the varying impact of this factor on manpower utilization in Burma.

Seasonal unemployment cannot be solved alone and apart from solving the problem of general under-utilization of the labor force of Burma. If many more job opportunities can be created generally, then the task of overcoming seasonal unemployment will become much more manageable. There is little to be gained by concentrating attention on wasted manpower resulting from seasonality, when substantial unemployment and underemployment are common throughout the year. On the other hand, seasonal unemployment can persist even when workers are generally being sought. Under such circumstances, special programs are needed to encourage economic activities which complement each other seasonally in each locality, to facilitate the mobility of labor and to afford training opportunities so that workers can engage readily in more than one occupation.

Changes in the character and technology of agriculture could contribute to more stable agricultural employment. Second cropping in the delta would provide more steady jobs and greater income to both the cultivators and the workers. However, the introduction of agricultural innovations is usually a slow process, and there are limits to what can be done to assure regular work in agriculture.

There is a pressing need for a wide range of public works all over the country which would not only raise the standards of welfare services for the people, but would also facilitate industrial development. Much seasonally idle manpower can be productively used in improving the network of roads, the building of schools and health clinics, the construction of housing, the provision of sanitation and waste disposal facilities and other local public works which could be scheduled seasonally so as to take advantage of the off-season slack in agricultural jobs.

The process of industrialization of Burma will be a gradual one, and the economy will not soon be characterized by large-scale enterprise. In fact, encouragement should be given to geographically dispersed small-scale production units geared to growing local markets and requiring limited capital. With government aid, improved cottage industries can be established in a great many

areas where seasonal factors will make available a sizeable working force at regular intervals.

Training facilities and programs can be geared to seasonal unemployment conditions. The coincidence of the university vacation and part of the dry season is helpful in that students and faculty members may be available for training and also perhaps for supervisory and administrative jobs on seasonally-peaked public works.

Recognition must be given to the need for incentives in the form of a greater supply of consumer goods. Workers whose seasonal employment yields sufficient income in cash or in kind to provide the minimum essentials of life may be hesitant to seek or accept systematic off-season work unless there is a greater variety of consumer goods which can be bought with the supplementary income. Of course, the added work will in turn make some additional goods available to consumers but the government may have to take the lead in making incentive goods readily available.

These suggestions can be helpful in reducing seasonal unemployment, but it should be reiterated that more facts are needed to better understand the nature and extent of the problem, and that steps to increase employment opportunities generally should receive primary attention at this time.

C. LABOR INCOME AND LIVING STANDARDS.

1. THE MAJOR LABOR GROUPS. Of the approximately 8 million persons in the labor force, some 5½ million are agricultural workers (cultivators and their family members, plus hired laborers), while some 2½ million are distributed in non-agricultural occupations. These include the extractive, government, public utility, trade, industrial, processing, service and other occupations. The non-agricultural workers may be divided broadly into two major groupings; those who are relatively better-paid, and those who are relatively poorly-paid. The first of these is comprised of government employees, public utility workers and workers in the larger industrial and trading concerns, and may number a few hundred thousand. The second group consists of seasonal and casual workers, domestic servants, employees in small enterprises, and also persons self-employed in cottage industries and petty trade.

2. THE "BETTER-PAID" WORKER GROUPS. The relatively higher wages earned by some groups of workers may be attributed to 1) the limited number of skilled and educated workers available; 2) the wage practices of the government; 3) the relatively high productivity of the industrial enterprises in which many of them are engaged; 4) the concentration of trade-union organization in these occupations; and 5) the fact that the provisions of existing labor legislation can be enforced more easily in these fields.

A factor in the wage levels for this type of labor is the Government's own employment activities. Because of its important role in direct economic activity—(transport, communications, marketing, trade and industry)—because of the concentration of higher grades of labor in the Rangoon area and their close proximity to the large Government bureaucracy, and because of the psychological and administrative influence of Government, the Government's pay policy and practices have some influence on the rate of earnings of workers in other employments.

a. *Pay of Government Employees (Civil Servants).* The basic pay rates of Government employees have been changed once since the war—in April, 1948. Additional flexibility has been provided by cost-of-living allowances (C.L.A.). These currently substantially exceed basic pay at the lower income levels and increase with less progression than basic pay as higher income brackets are reached. For the top basic pay jobs, no such allowance is paid. These allowances were inaugurated in 1946 and amended in 1948.

The current pay of Government employees (base rate plus C.L.A.) has risen much more for lower-paid employees than it has for higher-paid employees since before the war. The following tabulation is said to approximate the experience of a broad range of Government employees in the Rangoon area.

	Typical Monthly Pay in Rupees		
Class of Employee	*Prewar*	*Current incl. C.L.A.*	*Per Cent Increase*
Peon	16	82	412
Lower Division Clerk	50	110	120
Upper Division Clerk	100	190	90
Superintendent	320	420	31

C. L. A. was originally based on the assumption that the postwar rise in the price level would be temporary only. Since it is obvious that a very considerable price deflation is out of the question, serious consideration should be given to the revision of basic pay scales to include cost of living allowances.

As examples of Government pay scales for work in industrial occupations, the current wages paid in the Government spinning and weaving mill are cited below:

Learners	Rs. 3	per day (about 70 per month)
Unskilled	Rs. 3-3½	per day (about 80 per month)
Semi-Skilled	Rs. 4-5	per day (about 110 per month)
Highly-skilled	Rs. 5-6	per day (about 130 per month)

b. *Wages in "Better-Paying" Industries.* In September, 1951, the Burma Labor Gazette began to publish data on the average monthly incomes of permanent workers in selected industries. The statistics are admittedly crude because 1) their coverage is incomplete; 2) there is no

check on the validity of the returns; 3) the wages of managerial as well as of production workers are included in calculating the average wage. Average monthly wages for January and February, 1951, are given below, by industry, together with the number of establishments and the number of workers on which they are based. The list includes state-owned enterprises, notably transportation.

Industry	*No. of Establishments*	*No. of Workers (Permanent)*	*Average Monthly Income (Rupees)*
Banking	17	1,359	213.3
Air Transport	4	155	193.7
Oil Mining and Associated concerns	10	4,260	178.1
Printing and Stationery	25	1,076	133.3
Motion Picture Industry	6	140	129.8
Ice and Aerated Water	14	589	128.2
Amusements— (Cinemas and Theaters)	13	362	120.0
Sea and River Transport	5	7,771	118.3
Railways Transport	1	18,863	114.9
Match Manufacture	3	665	104.9
Sugar Extraction and Refining	2	397	102.4
Cheroots, Cigars, Beedy Manufacture and Associated Concerns	12	1,131	95.5
Flour Milling	40	205	93.0
Rice Milling	425	8,210	90.9
Road Transport	3	72	90.7
Saw Milling	105	3,444	81.5
Cotton Ginning & Spinning	32	217	79.8
Engineering Work	6	128	72.4
Sesamum & Groundnut Oil Extraction	35	227	71.1
Rope Manufacture	5	292	68.9
Total	763	49,563	116.6

It is obvious that average monthly wages in the manufacturing and processing occupations fall, for the most part, in the Rs. 80-100 per month range, while oil extraction and transport employ most of the workers earning substantially higher wages.

The figures cited above are country-wide, and represent both urban and rural areas. Some indication of the order of magnitude of incomes in urban centers, regardless of type of work performed, is given by the findings of the Rangoon Sample Survey conducted in January, 1950. These are summarized in the following table:

Estimated Distribution of 108,000 *Households in Rangoon by Income Group*

Income Group (in rupees)	*Percentage of Total In Each Income Group*
0 - 100	32.3
101 - 200	27.1
201 - 300	12.8
301 - 400	7.8
401 - 500	7.1
501 - 1,000	10.1
above 1,000	2.9

These figures indicate that about one-third of the households in Rangoon, many of them comprising two or more workers, received incomes of less than Rs. 100 per month. An additional 27 per cent were in the Rs. 100 to 200 per month group. About three-fifths of all households received total incomes of less than Rs. 200 per month. Half of all the households had combined incomes of Rs. 165 or less per month. It would appear that in the Rangoon area, unskilled laborers earn from Rs. 70 to 90 per month, while skilled factory workers earn from Rs. 110 to 150 per month. The Rangoon dockers, for example, who are well organized now, receive about Rs. 100 per month. Street cleaners in Rangoon receive Rs. 86 per month. The minimum wage for civil service employees, which is fixed by the Minister of Finance, has been raised to Rs. 82 per month (Rs. 42 of which is cost of living allowance). Although there are certain exceptions, even in Government, this may be taken as the minimum rate of pay for relatively better-paid labor in Burma.

3. THE MORE "POORLY-PAID" WORKER GROUPS. The earnings of workers in the more poorly paid occupations are less well known. No data are collected, payment is often in kind (as in the case of board and lodging of domestic servants) and employment and earnings fluctuate greatly. The general picture in Rangoon at least, is reasonably clear. These workers have little or no bargaining power and are habituated to an extremely low standard of living. Low pay levels are aggravated by the Maistry system, under which the hiring boss frequently retains part of the meager wage intended for the worker. That circumstances are probably worse outside Rangoon is suggested by the fact that refugees seem to be favorably impressed with the opportunity of earning two to three rupees a day as casual laborers in Rangoon. This rate of pay, with highly irregular employment, represents the top income level for such workers. At the bottom are found the sidewalk hawkers and the unemployed. It appears that the average wages of workers in the more poorly paid occupations do not exceed Rs. 50 to 60 per month, and may well be below Rs. 50 per month.

4. WHAT WAGES WILL BUY. With average monthly wages ranging for the most part from Rs. 100 to 150 per month for skilled workers to Rs. 70 to 90 per month for regularly employed unskilled workers, to perhaps Rs. 50 to 60 per month for casual, irregularly-employed or under-employed workers, the question arises: What can these workers buy for their money? What kind of living can they provide for themselves and their families? What kind of market do they provide for the products of farm, mine, mill and factory?

The Directorate of Labor's latest report on the cost

of living index indicates that a Burmese family of three units living on an austerity basis in Rangoon requires a minimum of Rs. 101.7 for food, rent, cloth, fuel and light, and miscellaneous items. Of the Rs. 101.7, 69.9 are for food, 12.5 for rent, 5.4 for fuel and light, 9.7 for cloth and 4.3 for miscellaneous items. This austerity budget, which is based on a family of less than average size, may perhaps be called a bare subsistence budget. It presumes the family will go barefoot and bareheaded, walk to work, do without medical supplies or attention, live without furniture and household supplies, and survive on four ounces of meat and fish and two-thirds pounds of rice per person per day, supplemented by a little oil, salt and a few vegetables. (The details of this austerity budget are shown in Table VIII.) And yet a great many workers and households in Rangoon earn less than Rs. 102 per month!

It is clear from the above that urban workers in Burma are now living below minimal standards. An increase in the demand for their services to furnish them full-time and more productive employment would be of immediate benefit. A development program which would increase their productivity is a basic need.

5. FARM INCOMES AND LIVING LEVELS. The income position of the rural population is most difficult to appraise. Facts on the current situation of the cultivators and of the farm laborers are too obscure to permit reliable judgments to be made. Satisfactory data on production, costs, prices actually received, prices paid for supplies, wages, etc., are completely lacking. Such factors as the widespread practice of paying farm help in kind, instead of cash, and the irregularity of non-farm work performed in the off-season, complicate the picture even more.

A few broad facts, however, seem clear. So far as the paddy cultivator is concerned, the yield per acre under cultivation has declined and the price he gets for his paddy has doubled, at most, since 1941. For part of his crop he may receive substantially less than the Government-supported price, which is twice the pre-war price, because he cannot wait until Government-purchase time. Farm laborers are paid for their labor up to double the prewar quantities of paddy. Since paddy prices have doubled, this means the cultivator is paying his farm labor as much as four times in value what he did before the war. At the same time, the prices the farmer has to pay for the things he buys have increased to four or more times their prewar levels. So far as agricultural credit is concerned, the Government's farm loans and the activities of the credit cooperatives do not begin to fill the gap left by the Chettyars, money lenders of Indian extraction who formerly provided the bulk of agricultural credit. The cultivator must now resort to Sabape loans (repayable in paddy) at interest rates far in excess of those he previously paid.

This squeeze between vastly-increased costs on the one hand and lower yields and only moderately higher sales prices on the other hand, has in all probability cost the cultivator more than he has gained by the widespread remission of Government loans and the non-collection of rents and land revenue taxes in recent years. Some personal interviews with cultivators in the Rangoon area suggest that, after meeting all costs and feeding himself and his family, the operator of a 50-acre paddy farm may net from 100 to 200 baskets of paddy worth 300 to 600 rupees to reward him and his family for their work.

So far as farm labor is concerned, their position rela-

TABLE VIII

DATA USED IN COMPUTATION OF COSTS OF LIVING OF A BURMESE LABOR FAMILY (3 UNITS) in RANGOON (ON AUSTERITY BASIS) FOR THE MONTH OF OCTOBER, 1951.

Name of Commodity or Items	*Quantity Consumed Per Month*	*Average Price Per Unit of Quantity October 1951*	*Average Monthly Cost October 1951*
Rice—Kamakyi	22.5 pyi (approx. 65 lbs.)	0.750	16.9
Pulse—Arhar Dhal	1.00 viss (3.65 lbs.)	1.389	1.4
Oil—Sesamum	1.50 viss (5.48 lbs.)	5.806	8.7
Meat and Fish			
Fish, fresh Ngayan	3.75 viss (13.69 lbs.)	4.056	15.2
Fish, dried & salted	0.40 viss (1.46 lbs.)	9.000	3.6
Ngapi, Thon-u-zat	0.80 viss (2.92 lbs.)	2.639	2.1
Pork	1.885 viss (6.88 lbs.)	5.000	9.4
Sundry Foodstuffs			
Salt	1.00 viss (3.65 lbs.)	0.500	.5
Tamarind	0.50 viss (1.83 lbs.)	1.250	.6
Onions	1.50 viss (5.48 lbs.)	1.917	2.9
Chillies	0.75 viss (2.74 lbs.)	2.250	1.7
Green vegetables	(Estimated Average Cost)		6.9
	Total Cost of Sundry Foodstuffs		12.6
	Total Cost of Food		69.9
Fuel and Light			
Kanasoe firewood (12")	110 splits	3.500	3.8
Kerosene (24 oz. bottle)	5 bottles	.313	1.6
	Total Cost of Fuel and Light		5.4
Cloth			
Lonkyi, cotton	1.25 yards	3.000	3.8
Grey shirting	1.25 yards	1.125	1.4
Twill Khaki	0.75 yards	3.750	2.8
Longcloth	0.75 yards	2.250	1.7
	Total Cost of Cloth		9.7
Miscellaneous			
Soap, dhobi white	6.00 cakes	0.250	1.5
Tobacco, cheroots (100)	0.50 units	5.500	2.7
	Total Cost of Miscellaneous Items		4.2
Rent			12.5
	Total Cost		101.7

tive to that of the cultivator has improved as compared with prewar. Typical prevailing rates for a 50-acre farm in the Rangoon area are: laborers hired for plowing, 40 to 60 baskets each; herdsmen employed after plowing, 30 baskets each; transplanters, 1 rupee plus 2 meals per day each; reapers, 4 baskets per acre; and harvest hands, 4 baskets per acre for the harvesting operation. These are reportedly double the quantities of paddy paid prewar, which suggests that in terms of purchasing power, the farm laborer is at least as well off as he was before.

Again, as in the case of the cultivator, too many important facts are missing for any valid appraisal to be made. There is no information on how many weeks or months of farm work the farm laborer performs, nor how many of his family work to augment the family income, nor how much income they obtain from non-farm work during the off-season.

It would be dangerous to attempt to propose any major policies based on such inadequate and shaky foundations. The uncertainty as to the actual facts in an area so vital to Government policy is the strongest kind of argument for vigorous action in the direction of definitive fact-finding and reliable and pertinent statistics.

6. CONCLUSION AND RECOMMENDATIONS. The difficulty in arriving at even crude estimates of wages, earnings and employment indicates the need for the Government to broaden considerably and improve its statistical activities in this field. Further, the cost of living index should be revised to provide realistic bench marks for a minimum health and decency level of living for a typical Burmese family in several key cities throughout the country.

However, the meager data available do provide dramatic evidence of the urgent need on the part of Burma's people for an economic development program. To recommend how these living levels may be raised is the purpose of this entire report.

D. EDUCATION AND TRAINING.

1. INTRODUCTION. In a very proper sense, the greatest single capital asset of a society is the education and training of its labor force. Regardless of the wealth of natural resources or of the skill and ingenuity with which organization and plans are developed, the rate of economic progress will be considerably affected by the availability of trained persons adept in the ways of modern technology. The view that the problems of less developed areas would be readily solved if only capital goods—machinery, transport, factories—were available, is a common over-simplification. Without trained personnel, productive equipment cannot make its maximum contribution. Actually, a generally educated population skilled in modern production methods, providing natural resources are available or can be secured, can produce their own producer goods. This is dramatically illustrated by the relatively rapid post-war recoveries of the Japanese and western European economies in spite of great wartime losses of capital equipment.

The utilization of foreign technicians and the acquisition of externally-produced capital goods can no doubt greatly speed up the industrialization process for a nation just embarking on a large scale development program. Even with such assistance, however, a shortage of skilled personnel threatens to retard seriously Burma's plans for economic progress. Experience with the relatively modest reconstruction and development projects initiated since the war indicates that it is doubtful whether even the capital goods attainable with current foreign holdings could be put to efficient use given the *present* availability of trained personnel. This serious bottleneck can be overcome if the necessary effort is put forward in time. Given the determination, Burma's skilled manpower needs can be supplied. This section will outline the present situation with respect to education and training, and indicate some of the considerations involved in effecting the necessary improvements.

2. GENERAL EDUCATION. Ultimately, it is the primary and secondary educational system of Burma which will provide the basis for a fundamental economic transformation. The ability to read, write and perform simple calculations, to think clearly and communicate ideas, are basic tools for modern living and higher productivity. Together with the basic understanding, knowledge and work habits which are the goals of modern education, they are an indispensable preparation for the advanced technical training discussed below. This minimal education is something to which each child is entitled. Society requires it as well, so that the potentialities of all its children may not go undeveloped.

Precise data are not available for measuring Burma's achievements in primary and secondary education. Some crude estimates are possible, however. These indicate that the size of the task ahead is indeed a great one.

There are roughly 5,550 state primary schools in the whole of the Union of Burma, which utilize the services of something over 13,000 teachers. Assuming the age pattern of the population to be the same as in 1931, there are over 2¼ million children in the relevant 5-10 year old group. This would indicate overall ratios of 1 teacher for every 170 children of school age, and 1 school for every 410 children. The UNESCO Educational Mission estimated, however, that for Divisional Burma (excluding the frontier areas and Shan States), some 195,000 children attended infant or kindergarten classes, that about 185,000 in the 5-10 year old group

attended the primary grades, and an additional 200,000 receive some training in monastery schools. It would appear therefore that about 70 per cent of the eligible children in the area surveyed by the UNESCO Mission have no means of education at all outside the home. Outside Divisional Burma, the position is considerably worse. Rough calculations indicate, for example, that only 8 per cent of those eligible attend primary schools in the Shan States. Only 6 Government (and 20 private unrecognized) primary schools minister to some 8,000 children in Kayah State.

In the 10 to 15 year old age group, on the basis of extending 1931 population figures, over 2 million children are of secondary school age. There are, however, only some 225 schools and less than 1,500 teachers, indicating overall ratios of 1 teacher to 1,400 children and 1 school to 9,000 children. Here, also, the inclusion of private schools improves the picture only slightly. Although no estimates can be made of school attendance, it is much smaller percentage-wise than that of primary schools.

Clearly, the number of teachers, schools and pupils attending schools is seriously inadequate. Such educational aids as school furniture, books and maps are now at a minimum. This is due partly to wartime losses, partly to a lack of funds, and partly to a lack of ability to use modern teaching aids. This last factor is a product of the dominant philosophy of education which is oriented to an academic course of instruction, verbally communicated.

The total capital requirements for expansion and modernization of the general educational system will be large. The survey group will take these capital requirements into consideration in dealing with resource use and capital requirements for economic development.

3. PROFESSIONAL, TECHNICAL AND VOCATIONAL TRAINING. These types of training are of the most immediate urgency. No estimates of manpower requirements by type of skill are presently available. However, even at the present low level of economic activity, there are pronounced shortages of (a) all sorts of professionals; (b) trained technicians, superintendents and foremen; and (c) many grades of skilled workers as well. If a large development program is undertaken, these current shortages will multiply rapidly.

a. Professional. Primary responsibility for providing technicians of the first order—engineers, chemists, physicists, biologists, agronomists, soil scientists, economists, educators, medical doctors, accountants, experts in management and production control, etc.—is vested in the University of Rangoon, with its affiliated colleges at Mandalay. A breakdown of the student body in 1949-1950 follows (The "intermediate" arts and science course is basic to further studies leading to degrees and to professional studies):

Students in the University of Rangoon, 1949-50

1.	Sciences and Arts (1st two years)	1,151
2.	Arts (History, Philosophy, Literature, etc.), 2 years	432
3.	Sciences (Chemistry, Physics, Biology), 2 years	163
4.	Engineering (4 years)	189
5.	Law (2-year post-graduate course)	157
6.	Medicine and Surgery (5-year course)	376
7.	Education (2-year post-graduate course)	25
8.	Commerce (2 years)	59
9.	University College, Mandalay (2 or 4 years)	218
10.	Mandalay Agricultural College (2 years)	23
	Total	2,793

The professional training conducted at the University of Rangoon is currently supplemented chiefly by the program of State Scholarships for advanced study abroad. The following table shows the distribution of State Scholarships for study abroad by field of study for those trained since the war, those presently studying abroad, and those whose study is presently planned.

STATE SCHOLARSHIPS ABROAD

Field of Study	*Trained Since the War and Already Returned*	*Presently Abroad*	*Provisionally Selected & Awaiting Admission*	*To be Selected for 1951-52*
Education & General Arts [1]	16	20	3	22
Mathematics & Mathematical Statistics	3	—	—	7
Chemistry	3	8	3	10
Geology & Metallurgy	3	7	4	24
Physics & Meteorology	2	4	1	2
Economics & Economic Statistics	10	10	5	19
Agriculture & Botony	2	2	3	4
Engineering [2]	8	22	13	69
Social Services & Health	7	9	7	29
Veterinary & Zoology	—	2	2	11
Transport [3]	2	48	14	9
Forestry	5	3	1	3
Industry	6	6	5	21
Total	67	141	61	230 [4]

[1] General Arts includes History, Librarianship, Journalism, Publicity, Mathematics.

[2] Engineering includes all engineering subjects except those connected with transport and chemical engineering.

[3] Transport includes Marine Engineering, Marine Executive Officer training, Railway Engineering, Civil Aviation, Aeronautical Engineering, etc.

[4] Thus far, budgetary provision has been made for 90 only.

It is encouraging to note that the number of Burmans who will have the opportunity to engage in advanced study abroad is growing, and that the distribution of such students is shifting in emphasis to training in engineering, social services and health, economics, industry and geology. A greater emphasis on agriculture, however, is certainly to be desired, although the increasing emphasis on veterinary and zoogeology training is to be commended.

Still other provisions for professional study are made

by the Fulbright, British Council and U.N. scholarships and fellowships, as well as by deputations of Government servants abroad.

However, the chief observation to be made is that the professional training presently conducted, both at home and overseas, is decidedly inadequate for Burma's needs. Ambitious and vigorous expansion of current levels of professional training in all fields is a prime requirement of the economic development program.

b. Technical. Equally great emphasis must be placed on the need for expanding the scope and intensity of the training of sub-professional technicians. At the present time, the chief institutions available for such training are the Technical Institute at Insein, the Polytechnic, the civil engineering classes conducted by the Government, and a few private institutions such as the Tiger Technical School. Detailed plans for rebuilding and re-equipping the Technical Institute with American aid have been made. A great deal more, however, needs to be done.

The first step necessary is to appraise how large a program of training needs to be undertaken, and in what skills. This will be one of the major tasks confronting the incoming Director of Technical Education. This survey group will contribute to the greatest extent it can. An organizational problem which merits serious consideration is whether the Directorate of Technical Education should reside within the Ministry of Industry and Mines or within the Ministry of Education.

It should be kept in mind that varied means will probably need to be employed to train the requisite personnel in the skills desired. Intensive short-term courses, as well as the more lengthy and thorough training courses, may be desirable. In-school training will need to be supplemented by in-service and apprentice types of training, as well as by study abroad. Finally, it will be necessary to "learn by doing" on the job itself.

c. Vocational. The formal training of skilled workers is primarily a job for artisan training centers. The Training Center in Rangoon can provide a useful experience in this regard. Additional centers are planned for Mandalay, Akyab and other cities. Vocational training of two brigades of ex-dissidents has been organized at Insein and Prome. Handicraft training is also conducted in the Saunders Weaving Institute at Amarapura, the Lacquer School at Pagan and in a general handicraft school in Rangoon. In addition, the Government maintains 12 weaving schools and has planned 6 others, and also maintains a staff of 23 weaving demonstrators in the field. Four additional weaving schools are maintained by the States.

The development and operation of a greatly expanded program of vocational training is a complex, difficult and costly task. Among the major problems involved are: (1) determination of the skills in which training is needed; (2) adjustment of the training courses to the methods and conditions which will prevail in the actual work to be done; (3) the location and equipment of the training centers; (4) staffing the training centers with capable teachers who combine vocational skill with pedagogical skill; (5) ensuring an orderly flow of repair and replacement parts, tools and materials needed in the training courses; (6) guiding prospective students into those fields of training for which they have the greatest aptitude; (7) stimulating the necessary student registrations, and extending the necessary financial assistance to desirable students so that they can pursue their training; (8) providing job placement services for students completing their studies; and (9) maintaining close contacts with industrial developments, methods and needs, so that the training program can remain geared to requirements.

Ideally, there should be one or more vocational training institutions in every industry center offering a variety of training courses in the skills needed or likely to be needed in that area. A typical center might offer training courses in metal working and machine shop, woodworking, auto-mechanics, electrical work, radio-mechanics and repair, dental mechanics, spinning and weaving, shoemaking, general construction, plumbing, and the like. Practical training should be enforced and enriched by at least minimal theoretical instruction requisite to the particular skills involved. Certificates of proficiency should be awarded to those completing courses and passing examinations.

The courses offered should be variously adapted in duration, intensity and timing to the types of students who will have to be trained. For young people, day courses involving more thorough training of one to two years duration should be offered. For adults, intensive, short-term courses of three to six months will be more appropriate. In addition, "improvement" courses of one to three months duration may be offered at night for workers already on the job.

Courses in training centers, however, should not be counted upon to do the entire job. Experience in other countries has shown that apprentice training on the job can be most valuable. It is most effective if well organized and especially if supervised by the training authorities in cooperation with the employer. Industry itself can do a satisfactory training job in the plant, in many cases, if it makes a real effort to do so.

Finally, there is the important problem of training the vocational training teachers. All too often, such teachers are selected on the basis only of their experience and skill in the vocation concerned. With this fundamental requisite, however, it is desirable to combine some skill in teaching. It will be found worthwhile, in staffing artisan

training centers, to conduct short in-service training courses in pedagogy for the skilled artisans selected to teach their trades.

It will also prove useful to institute a scheme for the registration of all technical and scientific personnel in Burma, as was suggested in the Two-Year Plan.

A special note on the Rehabilitation Corps is warranted here. This project was conceived as a practical means of combatting insurrection and dacoity by providing constructive and practical occupational opportunities for young men who, in the absence of such opportunities, turned their energies to destructive and anti-social purposes. The possibilities of this imaginative undertaking should be fully exploited. If a well-planned program is developed and carried out, it will become more than just an effective means of combatting insurrection; it will make a major contribution to economic reconstruction, and train a great many of the nation's young men in skills badly needed for the economic development program as well. Careful study of the current organization, programs and practices of the Rehabilitation Corps, and of existing plans for expansion, is needed to ensure that the great potential of the Rehabilitation Corps is fully realized.

4. MASS EDUCATION. A backward economic development and an inadequate educational system have resulted in a pattern of living and working throughout Burma relatively untouched by modern knowledge. The rudiments of health maintenance and sanitation are insufficiently known; agriculture is carried on in inefficient, primitive ways; local resources are not effectively utilized; home-made products and those of cottage industries involve unnecessarily painstaking labor; and knowledge about and participation in political affairs is greatly confined. Obviously, this situation is a fetter on economic development.

The government has determined to lift the general level of understanding and culture of the people through a mass education program. Under the provisions of the Mass Education Act of 1948, a Mass Education Council has been created to supervise the program. A "Training Center for Adult Education Workers" in Rangoon offers 6 months' courses, and some 200 of a planned 700 workers have already been trained. Close to a hundred units are operating in the field, each attending to several villages for a period of about six months.

Although the operation is in its infancy and only limited observation of field units has been possible, certain lessens can be learned from the experience so far. Adequate audio-visual and other training aids which make for attractive presentation are needed if the program is not to degenerate into a lukewarm literary campaign. These include simple handicraft tools, basic medicinal drugs, recreational equipment, wireless sets, charts, diagrams and educational film. They include also local libraries, catering to the interests of the villagers, which arouse the desire for literacy and help retain and develop acquired abilities.

More "know-how" on the part of the educators is indicated. The UNESCO Commission's recommendation concerning specialization of functions—health, agriculture, home and child care, recreation, handicraft—within a larger team merits consideration. Mobile teams, ministering to training in agriculture, village industry and health and sanitation have been proposed separately. Coordination of these with mass education units, where possible, might economize personnel and equipment and give momentum to each other's operations.

5. TEACHER TRAINING. The greatest single obstacle to rapid expansion and improvement in all fields of education is the shortage of teachers and teacher training facilities. It is highly unlikely at present that normal replacements are being provided. The State Training College for Teachers in Rangoon, which is the main source of trained lower-standard teachers, turns out a little more than the 100 graduates per year, and about 200 village school teachers have been trained at the Village Teachers Training School at Taunggyi since its establishment in 1947. The University of Rangoon, where high school teachers are trained, has graduated only 36 of these in the past four years.

It is clear that the problem must be attacked on a broad front. The immediate need is for more training schools of the village type located in the Districts, where back country teachers can receive training and return to their localities. In addition to the University of Rangoon, at least one additional general teachers' training college is required now in Upper Burma. Wherever possible, refresher courses in the more practical curriculum should be provided for present teachers in these schools during vacation periods. Orientation of the training in all these institutions to the new curriculum will involve more training equipment than has been customary in the past.

Pay scales for teachers are low and they should be analyzed with a view of assuring comparability with other positions of equal responsibility and sufficient inducement to attract the most capable persons into this important profession.

6. FINANCE. The 1951-52 Government Budget estimates for the field of public education are given in the following table:

While this represents a sizeable increase over the 1950-1951 budget, six crores is far too modest a sum to do the job that needs to be done in the various fields indicated below. A budget of needs must be prepared which is related to what can be accomplished under an intensive

educational program along the lines recommended. Further investigation is needed to arrive at such a comprehensive and definite program.

Current expenditures		Rs. 4,29,52,320
Grants to Universities	30,00,000	
Secondary schools	1,00,00,000	
Primary schools	2,01,16,000	
Special schools	1,09,190	
Compulsory primary education scheme	90,200	
Scholarships	12,62,000	
Text books, office	56,14,300	
Administration inspection and misc.	27,60,630	
Capital Outlay		Rs. 1,44,12,000
School buildings	84,12,000	
Furniture	40,00,000	
Grants to universities	20,00,000	
Vocational Education (non-university)		Rs. 9,47,160
Insein Technical Institute	2,46,500	
Artisan Training Center	2,84,000	
Handicraft Schools	3,32,630	
Miscellaneous	84,030	
Mass Education Council		Rs. 10,00,000
Teacher Training		Rs. 3,09,680
Teachers Training School	2,94,680	
Vocation Course for Teachers	15,000	
Total		Rs. 5,96,22,160

E. HEALTH AND WELFARE.

1. HEALTH. Statistical information on the health of the people of Burma, especially since the insurrection, is limited. Even the data which are available are likely to suffer from limitations of coverage and definition. Diagnoses of causes of illness and death are often those of the family or village headman. Data on specifics usually understate the facts. Even so, there is enough evidence to show that the state of public health in Burma is deplorably bad.

Deaths are one significant measurement reflecting health conditions. The average life expectancy in Burma today is perhaps half the life expectancy in the United States. Three per cent of the population dies every year —an inordinate rate for modern times. The infant mortality rate is one of the highest in the world. More than one-fifth of all infants born die before the age of one (counting only live births). In seventy larger towns of Burma, the rate was 30 per cent in 1947; it was 27 per cent for fifty-three towns in 1948. Half of all the children born alive in Burma die before they are ten years of age.

While small-pox, cholera and plague are not rampant in the country in the sense of widespread epidemics of catastrophic proportions, such epidemics are still annual occurrences in many districts. Tuberculosis, malaria, venereal diseases and all types of enteric diseases are chiefly responsible for the great annual toll of lives, for the loss of a huge total of man-days of work each year due to illness, and, in some measure, for the generally low level of productivity of the population. It has been estimated that eight million persons suffer from malarial fever in Burma. In large towns about 25 per cent of the population is venereally infected. As many as one out of every 200 in the population die of tuberculosis every year in some areas. Dysentery and diarrhea are almost universal. These diseases are so widespread and common that they are taken as "normal" and little is done by way of prevention or treatment.

Although cleanliness of the body and clothing are exemplary, living and working environs are conducive to the spread and continuance of all kinds of contagious diseases. Toilet facilities are generally lacking or so primitive as to speed the spread of germs. In the cities, drainage is neglected and refuse is left about for breeding of insects and vermin. Contaminated water is obtained from shallow wells with no siding and is consumed unboiled by most of the people. Although population density is relatively low for this part of the world, living in large family groups in cramped quarters is customary, and houses are crowded next to each other. Eating, sleeping and social activities are confined to small quarters. Maternity and child care practices are primitive. Diets are unbalanced and food preparation is unsanitary. Under these conditions malaria, tuberculosis, dysentery and diarrhea are easily contracted and contagious diseases are readily transmitted.

For most of the countryside and the larger part of town populations, the first resort in case of illness is home remedy, rituals or ceremonies. The last resort in most cases is a local untrained practitioner, the *Sesaya*, some of whom occasionally rely on magical formulae. In 1931 there were only 1,318 registered practitioners, most of whom were located in the larger cities. Almost 40 per cent of them were in Rangoon. As against these, there were some 20,000 persons practicing the healing arts without being registered. The herbs, roots and other medications employed by them are chosen partly on empirical grounds, and partly because of more abstruse considerations. One can hardly criticize this trust in the *Sesaya*, for modern medical care is generally unavailable, especially at fees which the average Burman can afford to pay. There is, however, no intractable taboo against western medicine. On the contrary, one of the problems of the small clinic is the overflow caused by mass infatuation with the prospect of better personal care.

The difficulty, of course, lies in the inadequate supply of medical services for prevention and treatment of ill-health. Responsibility for public health is vested in the Ministry of Social Services, within which the operating agency is the Department of Medical and Health Services. In turn there is the Public Health Section whose main duties are to give vaccinations on a large scale and to make sanitary inspections. A Hygiene Publicity Bureau of the Department of Medical and Health Services engages in some educational propaganda through the me-

dium of leaflets, posters and lectures. The actual work is largely carried on by field personnel of the Department—health officers, inspectors, mobile teams—who have other principal duties.

There are approximately 300 hospitals and dispensaries of all kinds in Burma—many of which are inadequately staffed and equipped. These provide in the neighborhood of 8,500 beds, something less than one bed per 2,000 of population, which is far below requirements. There are some 1,500 to 1,600 registered physicians engaged in private practice, supplemented by those doctors in government employment and some 650 nurses. Government-provided medical care is under the Department of Medical Health and Services, and the organization follows District lines through a system of civil surgeons. This system includes 90 per cent of the hospitals and about 20 per cent of all doctors and nurses. The quantity and quality of equipment—laboratory, x-ray, hospital furniture, etc.—are seriously inadequate and specialists and technicians are few in number. As a result of destruction of facilities, the production of vaccines and other drugs is much lower than prewar. These overall figures tell a story of shortages of all types of medical care, and of tremendous social losses in production through preventable death and sickness.

The incidence of many diseases, including most of those which are rampant in Burma, has been spectacularly reduced in many countries by the advances of modern medicine and sanitation. The results are not merely a lowering of the death rate and lengthening of the span of life. A much more satisfying existence for the people, greater social participation, and sizeable increases in work productivity are forthcoming when the population is freed from the curse of ever-present illness. Until the general standards of health are improved, any economic development programs which are attempted will be seriously limited by a physically-handicapped population.

Plans to meet this challenge are being formulated by the Ministry of Social Services. It has committed itself to a far-reaching preventive and medical care program. Several malaria, tuberculosis and venereal disease teams are now operating with ECA and WHO aid. As Burmans become trained, it is planned to have a sufficient number of teams of each type to cover the country systematically. Facilities for isolating and treating the estimated 100,000 leprosy cases are to be expanded. A separate Sanitary Engineering Division is now being established in the Ministry with responsibility for the environmental sanitation program.

The program calls for adequately staffed and equipped hospitals, geographically dispersed. For local service, 300 Rural Health Centers are to be provided, staffed with sub-professional medical personnel and concentrating primarily on preventive meaures. In each of these areas, a number of maternity and child health centers are to be provided. There is to be a program of Child Health Services for older children, operating in school health centers and with mobile teams. Specific plans for training increased numbers of doctors, nurses, public health assistants, public health nurses, midwives and other technicians are being initiated. With ECA aid Burma will soon be able to produce all the basic vaccines needed in the country, and make a beginning in the manufacture of medicinal drugs.

It is recognized that the plan is ambitious and goals will require many years to achieve. Yet it is well conceived. Some projects have already been placed on a time schedule. Because the goals are so high, it will be necessary to schedule the entire program carefully as to costs, facilities and training, so that allocations out of the available investment funds can be rationally planned.

It will take a long time for the National Health Program to reach the whole population—the isolated villager in particular. Yet, a significant and immediate increase in the health standards of the population as a whole would follow upon simple improvements in sanitary and preventive practices in general. The immediate task is to establish the conviction that this is so. This is a fertile field for mass education. Trained workers, living with the people and participating in the actual work of hygienic and sanitary reorientation for extended periods, could constitute one of the most important types of help which Government can provide for some time to come.

2. OTHER ASPECTS OF WELFARE. More adequate educational and medical facilities, expanded relief and rehabilitation programs, and improved public understanding in such important areas as sanitation, hygiene and maternity and child welfare represent the first priorities in a comprehensive Government program for social welfare. The effective execution of such programs will demand a maximum effort by Government for some time to come. However, there are additional Government responsibilities in this area which deserve mention here.

a. Housing. The problem of providing at least a minimum of shelter for everyone is almost entirely urban. A village dwelling is produced of local materials and is typically built in a short time by the inhabitant himself with the voluntary and generally unpaid help of his neighbors. This is true to a much lesser extent in urban areas. As to quality of housing, clearly the standards of most houses are far below what can be achieved with local resources.

Urban housing conditions are often worse than in the villages. War destruction, crowding in towns because of security conditions and the almost total absence of new construction has resulted in acute shortages. Not only are

more houses required, but there is widespread need for such basic provisions as indoor water, sewage facilities and garbage disposal.

The housing problem must be conceived most broadly. The construction of many new dwellings will raise questions of location, utilities, transportation, recreation facilities and the like. Urban Burma is faced with a job of city building and city planning. Cities must be zoned into residential, commercial and industrial districts, and adequate streets and utilities, recreational, health, educational and other necessary public services provided.

Organizationally, Burma has taken the first steps towards better housing. A National Housing Board has been created. A detailed slum survey of an area in Rangoon covering about 6,000 families, enumerating the number of occupants, type of housing, existing facilities in the house, job location, incomes, expenditures, etc., is nearing completion. This will provide valuable information on current housing facilities and needs at various income levels, and facilitate the planning job.

The 1951-1952 Budget allots Rs. 3½ crores for Govenrment housing activities. However, little building has actually been started. In the Rangoon area, one small 20-unit project for middle income groups and one large project contemplating about 2,000 units are to be initiated during this fiscal year. Some technical and financial assistance for Akyab and Prome reconstruction have also been proposed and approved by the Housing Board. Roofing being a key material, consideration is being given to the development of roof tile plants, and some $400,000 has been earmarked for the importation of aluminum roofing. A great deal more needs to be done to stimulate domestic production of those building material essential to more adequate types of shelter.

A housing construction program must be part of the overall development plan. Such a program is of great importance not only because of the consumer needs it satisfies, but also because of the important contribution it would make toward greater employment, output and productivity. Within the development program, therefore, housing needs are entitled to serious attention in considering competing claims for available resources.

b. Labor Legislation. Burma is well on the way to formulating a modern code of labor laws. Recent legislation governs the regulation of trade disputes, registration of trade unions, methods of wage payment, collection of labor statistics, job placement, minimum wages (British wage—council system), leaves and holidays and general working conditions in factories. Specific acts regulate the employment of labor in oil fields, mines and on the docks. These laws were formulated on the basis of recommendations made by a triplicate Labor Legislation Committee which studied recent legislation in neighboring countries and in England. Up-to-date laws on apprenticeship and workmen's compensation are needed, and plans for their enactment are under consideration.

Enforcement of these laws is handicapped by the small scale and disorganization which now characterizes Burmese industry and commerce, and more immediately, by the insurrections. It is generally recognized that considerable expansion of staff and some reorganization of functions in Government departments will be necessary before effective implementation may be expected. Because of their impact on the morale and productivity of workers, working conditions and labor welfare measures will require careful and continuing study.

c. Labor Unions. An effectively organized and socially responsible trade-union movement is a recognized part of the institutional structure of democratic states. Such a movement can benefit not only the workers but also the general well-being of the community. Labor organization in Burma, which was in its infancy before the war, is now definitely established. Following are rough estimates of membership:

Trade Union Congress (Burma)	30,000
Independent Unions (of this number, approximately one-half are members of the Railway Employees Union)	40,000
Burma Trade Union Congress	3,000 to 4,000

The economic development of Burma requires a healthy, productive and efficient labor force. The unions can help materially in satisfying this requirement, provided maximum freedom is permitted in the processes of organization and of bargaining.

d. Social Security. This important subject requires brief mention separately. As the Two-Year Plan remarked, "social insurance (including unemployment insurance) is a matter of utmost importance, but the organization and financial resources which will be demanded makes it of necessity a long-term measure in Burma". No overall legislation for old-age and unemployment insurance now exists. Government has a long-established pension scheme for civil servants, and a limited, state-sponsored unemployment insurance scheme for dock workers is now being put into operation. A few large firms have initiated plans on their own, and various laws place certain responsibilities on employers in this direction.

In essence, the individual economic security which is provided for in social security schemes, must be geared to the production of the total economy. As progress is made in raising the output of Burma, it is desirable that standards be set by legislation to assure protection to all persons from hazards against which the individual cannot adequately protect himself or herself. Measures in this field will be proposed as the overall program is developed.

Section III

THE FISCAL, MONETARY AND CREDIT SYSTEM

A. THE FISCAL SYSTEM.

1. INTRODUCTION. Government revenues and borrowing by the Union Government during the coming years will be the major source of domestic funds for a comprehensive development program. Also, the effective mobilization and use of domestic funds will no doubt have very considerable influence on the amount of foreign funds which may be made available. Therefore the fiscal system is of crucial importance for the entire program.

The use of the fiscal system to promote the development program to the maximum degree must be influenced by three major considerations:

a. How much investment the Government can and should finance in excess of its current revenues.

b. How high a level of Government revenues should be aimed at, to finance public investment.

c. What the composition or structure of the revenue system should be. Account must be taken of the varying effects of different taxes on the desire and will of individuals and companies to produce the maximum possible amount; and on their desire to spend for consumption or to save and invest.

In addition, it must be noted that the types and level of current Government expenditures affect the development program in a number of ways. Current Government expenditures for social welfare, by affecting the health, the living conditions and the education and training of the population, have great influence on its capacity and will to take part in the development program. The level of total expenditures for current purposes also influences the amount of Government funds available for investment. The amount of labor and other resources absorbed in current Government programs affects, to some extent, the amount available for development. Also, the more efficient Government expenditures are, the less funds and resources they use.

The general relationship of current social welfare activities of the Government to the development program was discussed broadly in Section II. Organization of the Government for the most efficient possible administration is discussed in Section XII. Only the three basic considerations of fiscal policy listed above are discussed in this section.

a. Investment in Excess of Revenues. Neither Governments nor private companies normally finance large-scale investments out of their current revenues year by year. They use surplus funds saved in the past or they borrow money or, in the case of companies, they obtain equity capital. The degree to which public investment outlays in excess of those financed out of current revenues can safely and advantageously be made merits careful analysis because many economic considerations are involved.

Government investment expenditures in Burma should be increased substantially at the present time, using idle cash balances and borrowed funds. The need for restoring capital equipment in Burma and adding to it is great. Many of the projects in the development program will be public and in the main revenue-producing. If well planned and operated, they will furnish the funds to service any debt incurred in developing them. Because there is at present so much idle manpower and so many unused material resources in Burma, even a large Government investment program will not divert materials or products from private use. Instead, the stimulus to private incomes will raise buying power and result in increased production for private use as well as for public use. Thus higher living standards can be reached at the same time that the instruments for more fruitful production and a rising standard of living in the future are being built.

Government investment at this time would have the advantage of increasing the amount of funds circulating in private use. There has been complaint by the business community that the Union Government, by accumulat-

ing funds in the Union Bank, and holding them idle there, has reduced the amount of money in circulation in the community and caused trade stagnation. The importance of Government accumulation of funds in relation to the present economic stagnation can easily be exaggerated; the basic cause of stagnation is the reduction of income in Burma because of the strangulation of domestic production by insurgency and dacoity. But it is true that the Government has accumulated idle funds, through continued receipts over a four year period by the Union Government and all of its agencies, in sizeable excess of disbursements. Government cash on hand in the Union Bank has risen from Rs. 38 million (3.8 crores) at the end of 1948, to Rs. 418 million (41.8 crores) at the end of 1951. These deposits can be productively returned to private circulation through Government investment.

Because of the idle men and unused resources at present, a concurrent increase in public investment and private consumption (with private investment also probably increasing) is possible now, and can probably continue for several years. But with an aggressive and substantial investment program, the time will come when public investment plus private spending will create demand for as much output as the economy is capable of producing at the time. Care must then be exercised against creating excessive total demand relative to total resources. A further increase in the pace of either public investment or private investment or consumption at such a time would create shortages and price increases. The pace of public investment can thereafter be safely increased only as total production goes up or if private consumption or investment is decreased.

It is not possible to tell in advance whether this balance between public investment and other demands for goods and services at a high level of production and employment will be reached with public investment confined to that which can be financed out of current revenues; or whether it will be necessary then to do added public investment by added borrowing; or whether such public investment in excess of current revenues will create excessive demand and shortages. This will depend on the level of private spending at that time. If individuals and companies are spending all of their current incomes at times of full employment, then Government cannot safely make expenditures in excess of its revenues. But if individuals and companies are not spending all of their current incomes, then Government can safely and properly borrow an amount equal to the current savings of individuals and companies, and spend it for investment purposes.

This matter merits some elaboration. Since Burma has great possibilities for development, it may be that when internal order is restored, and a high level of production and income attained, individuals will spend all of their incomes, either for consumption or for capital expenditure. If so, this spending plus Government spending equal to its revenues, will buy all of the goods that the economy is producing. Government investment in excess of current revenues, by creating added demand for labor and for commodities, would then create shortages and cause inflationary pressures.

But if private companies are holding some of their undistributed profits idle, or are using them to purchase Government securities; and similarly if individuals are saving part of their incomes and holding the savings idle or investing them in Government securities, then Government borrowing and investment in an amount equal to the idle private savings, will not create excessive demand or inflationary pressure.

The appropriate course of Government action cannot be forecast now, but must be determined by the situation as it then prevails. The simple principles stated above must be applied flexibly as the development program proceeds. Full employment, price stability and useful projects should be the principal determinants of the fiscal policy of the Government. Perfection in the coordination of these objectives is impossible to achieve, but the people of Burma will benefit immensely by the conscientious application of these sound concepts.

b. Taxation as a Means of Freeing Resources for Use in Public Investment. It may be that the balance existing between consumption and investment, as full employment is reached, is one in which the pace of investment is too slow to fulfill the development program. In that case consumption must be reduced if investment is to be increased. How high Burmese private consumption and private investment will be as full employment is approached, cannot be estimated at this time. Their levels will, in considerable measure, be determined by a variety of Government policies, an important one being taxation. Consumption might become so high, unless restrained by Government policy measures, as to leave too few men and other resources available for use in an investment program.

It should be emphasized that the objective of making possible higher living standards for the people of Burma is the foundation of this whole development program. However, at full employment consumption must not be allowed to use all the resources for then there will not be any investment and further progress will be impossible. Consumption must then be restrained.

It is conceivable that this can be done by measures to induce individuals to save an increased share of their incomes. As progress is made, total private income will rise and every effort should be made to induce the saving of a greater share of this growing income. Attempts

should be made to popularize savings deposits, both in savings banks and through postal savings; to stimulate the purchase of shares in building and loan associations and in cooperative association; etc. Campaigns should be undertaken to promote the sale of Government securities to individuals. The issuance of lottery bonds which involve a periodic drawing (say once a year) for several large awards, should be investigated.

But it is recognized that the mass of the people of Burma are not well acquainted with the use of savings banks, postal saving institutions, building and loan associations, the use of cooperatives as savings institutions, life insurance, or any of the other savings channels common in countries with more complex credit systems. Furthermore, neither their expenditure habits nor those of higher income classes will be easily or quickly changed; they are deep-seated. Lottery bonds may offer the greatest possibility of achieving some increase in private saving; but even if lottery bond sales are decidedly successful, neither they nor other methods of inducing savings are apt to increase savings enough to permit any marked increase in the pace of the development program.

In that case, the role of taxation in the reallocation of the country's resources becomes important. An increase of taxation in these circumstances will permit a corresponding increase in the public investment program, not merely because it furnishes the funds; more importantly, by cutting down private income it cuts down private purchases for consumption, and thereby frees labor and other resources for use in the investment program. Of course, there is no point in restraining or curtailing private demand unless there are inadequate resources available for investment requirements and unless the resources so released will be used efficiently for productive investment. Taxes are a basic means of controlling the use of the country's productive resources. Their effect in cutting down private use of resources, by draining away private income, makes them one of the important elements in framing fiscal policy.

Over a period of years, an increase in the pace of investment should be made possible through an increase in production. Progress feeds on itself. Eliminating bottlenecks, building improved productive equipment, establishing new well-planned industries, introducing improved methods in old industries—all of these will increase output and permit higher consumption and more investment at the same time. Of course, if more investment is wanted, then not all of the increase in output can be allowed to flow into consumption. The main fiscal-policy objective must be to fit the pace of domestically financed investment to a programmed excess of Government revenues over current expenditures plus the volume of private savings.

c. Revenue Measures as Incentives. Only brief observations can now be made on the third aspect of fiscal policy, the incentive or deterrent effect of revenue measures.

The revenue system should be equitable. It should be progressive; that is, it should distribute the costs of Government in accordance with ability to pay. The taxes should be collectable. A tax which is ideal on paper is a bad tax if many who should in equity pay it can evade it.

Either complex provisions or the administration of some taxes may disrupt or discourage production by requiring the expenditure of a considerable amount of time, money and energy by the persons or companies liable to the tax, so that they are unnecessarily diverted from productive activities. If the method of administering the tax has this effect, it may be possible to simplify it. If not—if the tax itself involves complications, this is an argument against it.

The provisions of a tax may discourage some actions and encourage others. For example, sales taxes or excise duties or customs discourage consumption of the specific goods which are taxed, but usually have only remote or insignificant effects on other goods. Income taxes are generally less restrictive on essential consumption, falling relatively more heavily on higher income groups. In a number of ways, taxes may increase the cost of a given type of business activity, or tax exemptions may decrease it; that type of production is correspondingly discouraged or stimulated. During future years, it will be desirable to stimulate maximum production; to stimulate savings as well; and to stimulate certain types of private investment while discouraging others. Many tax devices which are incentives to investment have been developed in other countries and are worthy of study and consideration. The effects of tax programs in this respect must not be overlooked.

2. PREWAR AND POSTWAR REVENUES AND EXPENDITURES. Table I shows total revenues, revenue expenditures, and other expenditures of the Union Government, for 1938-39 and five postwar years, as presented in the annual Budget documents.

"Disbursements outside the revenue account" are repayable loans and advances to various Government enterprises, municipalities, cooperative societies, and individuals. In an accounting sense they are loans rather than expenditures. "Revenue expenditures" are all other expenditures, i.e., those which from an accountant's viewpoint should be charged against current revenue. In the 1951-52 Budget, investment by the Government itself plus the repayable loans and advances are grouped together as capital expenditures, remaining expenditures being grouped as current expenditures. The large figure

for disbursements outside the revenue account in 1946-47 is due to an advance of Rs. 165 million (16.5 crores) to the Civil Supplies Department. This advance was largely repaid in the same year, but only the gross disbursement, without deduction for repayment, is shown under the heading of disbursements. In 1947-48 an advance of Rs. 147 million (14.7 crores) to the State Agricultural Marketing Board, swells the figures. This was fully repaid in the same year.

TABLE I

REVENUES AND EXPENDITURES, UNION GOVERNMENT, 1938-39 AND POSTWAR YEARS, AS PRESENTED IN THE BUDGET.

(Millions of Rupees)

Year	*Revenue*	*Revenue Expenditures*	*Surplus (+) or Deficit (—)*	*Disbursements Outside Revenue Account*
1938-39	164.3	154.0	+ 10.3	3.9
1946-47	310.9	424.0	— 113.1	301.7
1947-48	682.6	498.7	+ 183.9	383.5
1948-49	537.9	506.5	+ 31.4	94.3
1949-50	517.0 RE	536.1 RE	— 19.0 RE	74.5 RE
1950-51	649.3 RE	662.7 RE	— 13.3 RE	152.8 E
		Current Expenditures		*Capital Expenditures*
1951-52	583.8 E	542.5 E	+ 41.3 E	376.8 E

E = Budget Estimate; RE = Revised Budget Estimate.

Marked changes have occurred from prewar to postwar in the sources of revenue and in the types of expenditure. These cannot be fully understood without supplementing and reclassifying the budget data in some degree. As is apt to be true of yearly Government budget data in times of sharply changing circumstances, the figures are not fully comparable throughout the period.

One source of non-comparability is the changing role of Government Boards. For example, the Civil Supplies Department was created after the war to import supplies of scarce consumer goods and to distribute them through its own stores and through consumer cooperative societies. Its expenditures for the purchase of goods and its receipts from the sale of them bulk large in budget expenditures and receipts. But the gross receipts and expenditures of other important Government enterprises do not appear in the budget. Effective October 1, 1951, Civil Supplies was placed outside the budget accounts. Only its net advances from or repayments to the Treasury will appear in the budget accounts hereafter. This will result in considerable reductions in both receipts and expenditures, without corresponding change in the scope of Government operations. Similarly, in October, 1951, Burma Railways, whose gross receipts and expenditures have appeared in previous budgets, was moved outside the accounts, causing declines in both revenues and expenditures without corresponding changes in Government operations.

Almost all Government enterprises are now set up as Boards, and are not within any Ministry. Net losses of these enterprises are included in the data for expenditures, insofar as funds are appropriated to cover the deficits. But net profits of these enterprises are not included in the data for budget revenues, except that the "rehabilitation contributions" paid by S.A.M.B. and S.T.B. (State Timber Board) into the central treasury have been included. Yet these profits must be taken into account in considering the fiscal situation. Expenditure of these profits is for public purposes, and in the final analysis is subject to control by the central Government. S.A.M.B. profits have in part taken the place of land revenue. No meaningful comparison of prewar and postwar sources of revenue can be made without taking them into account.

Another source of non-comparability between years is the growth in importance of capital expenditures, some of which are included within revenue expenditures before 1951-52, but all of which are excluded from current expenditures in the 1951-52 budget.

To make the budget picture clearer to the reader, Table II presents supplemented and reclassified budget data. The adjustments made in the data are as follows:

a. Data for the postwar Government enterprises have been placed outside the budget accounts in all years, so that their gross receipts and expenditures do not appear in Government receipts and expenditures.
b. All net profits of these enterprises are included in the data for revenues, whether retained by the enterprise or paid over to the treasury as rehabilitation contributions. Net losses are included as current expenditures.
c. Identifiable net capital expenditures are separated from current expenditures in all years. This was already done in the budget for 1951-52. For preceding years, estimated expenditures for the construction of new physical plant or purchase of new capital equipment which in the Budget documents are included in Revenue Expenditures, have been added to capital expenditures in Table II.
d. Within capital expenditures, the repayable loans and advances have been put on a net basis. That is, repayments have been subtracted from disbursements, and only the net figure included. The published budget data presented in Table I are gross data. They do not reflect repayments.
e. Debt repayments by the Union Government have been excluded from expenditures.

For the sake of accuracy, it is important to note that the figures of Table II are not exact. In many instances, precise figures of the adjustments in budget data were

not available; the revisions are therefore estimates. Concerning minor items the revisions are no doubt incomplete. The adjusted data, however, give a generally accurate picture of the changes from year to year and over the entire period.

TABLE II

REVENUES AND EXPENDITURES, UNION GOVERNMENT, ADJUSTED FOR COMPARABILITY AND INCLUDING ALL NET INCOME OF GOVERNMENT ENTERPRISES, 1938-39 AND POSTWAR YEARS.

(Millions of Rupees)

Year	Revenues	Current expenditures	Current Surplus (+) or Deficit (—)	Capital expenditures	Total expenditures	Revenues Minus total expenditures
1938-39	164.3	141.8	+ 22.5	16.1	157.9	+ 6.4
1946-47	349.6	357.5	— 7.9	247.1	604.6	— 225.0
1947-48	582.6	378.4	+ 204.2	117.5	495.9	+ 86.7
1948-49	455.7	342.5	+ 113.2	65.3	407.8	+ 47.9
1949-50 RE	504.4	393.5	+ 110.9	71.1	464.6	+ 39.8
1950-51 RE	612.4	403.1	+ 209.3	152.3	555.4	+ 57.0
1951-52 E	646.8	551.4	+ 94.8	270.8	822.2	— 176.0

Source: All figures are estimates, based on Budget data and other sources. For 1938-39 and 1946-47 to 1948-49, the budget data are actuals; for 1949-50 and 1950-51, revised estimates; for 1951-52, original estimates.

The data indicate one impressive fact: when all income available to Government is included as revenues, revenues not only have greatly exceeded current expenditures, but have been considerably greater than the sum of current and capital expenditures, in each of the last four fiscal years. The cumulative surplus of revenues thus defined over all disbursements, in the four years, was Rs. 241 million (24.1 crores).

Table III shows main classes of revenue, and their relative importance, for 1938-39 and postwar years. The sources of Government revenue have changed greatly from 1938-39 to the present. Before the war, land revenue yielded almost one-third of total revenue, customs and excise duties more than one-third, taxes on income between 11% and 12%, forest revenue a little less than 9%, and miscellaneous sources the remaining 10.5%. In 1951-52, land revenue is expected to yield less than 4% of the total. Forest revenues will yield less than 2%. Profits of state enterprises, non-existent in 1938-39, will yield 40% of the 1951-52 total. Customs, excises and excise duties, plus the sales tax, will yield approximately the same share that customs, excise duties, and excises did before the war. The share of taxes on income has fallen to 7.3%, and the share of miscellaneous sources has risen slightly to 12.6%.

The most striking changes are, of course, the decline in land revenue, and the new importance of profits of state enterprises. These and other aspects of the present revenue system are treated in more detail below.

Table IV shows expenditures by major functions for 1938-39 and postwar years. The largest changes in the proportion of current expenditures for various purposes are the decline in the share spent for civil administration and the large increase in defense expenditures necessitated by continued disorder. The current expenditures for social and economic development must be considered, of course, together with the very large capital expenditures for social and economic development in the 1951-52 budget, which are shown in Table IV in the category of capital expenditures.

TABLE III

REVENUE, UNION GOVERNMENT, 1938-39 AND POSTWAR YEARS, CLASSIFIED BY TYPE

(Millions of Rupees)

Type of Revenue	1938-39 Rs.	1946-47 Rs.	1947-48 Rs.	1948-49 Rs.	1949-50 Rs.	1950-51 Rs.	1951-52 Rs.
Land Revenue	54.2	30.7	35.0	5.5	10.3	16.0	23.0
Forest Revenue	14.3	12.4	17.7	9.3	3.8	11.8	12.4
Customs	36.4	107.3	172.5	97.0	113.1	150.0	160.0
Excise duties and excises	23.0	18.1	20.9	16.8	19.3	30.4	30.3
Sales tax	—	—	—	—	—	22.0	30.0
Taxes on income	19.1	18.8	32.4	44.4	47.8	45.1	47.5
Profits of state enterprises (rounded)	—	118.	237.	241.	227.	251.	263.
Other	17.3	44.3	67.2	41.7	83.3	86.1	80.6
TOTAL (rounded)	164.	350.	583.	456.	504.	612.	647.
(PER CENT OF TOTAL)							
Land Revenue	33.0	8.8	6.0	1.2	2.0	2.6	3.6
Forest Revenue	8.7	3.5	3.0	2.0	0.8	1.9	1.9
Customs	22.2	30.7	29.6	21.3	22.4	24.5	24.7
Excise duties and excises	14.0	5.2	3.6	3.7	3.8	5.0	4.7
Sales tax	—	—	—	—	—	3.6	4.6
Taxes on income	11.6	5.4	5.6	9.7	9.5	7.4	7.3
Profits of state enterprises (rounded)	—	33.7	40.7	52.8	45.0	41.0	40.7
Other	10.5	12.7	11.5	9.3	16.5	14.0	12.5
TOTAL	00.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: For all lines except profits of state enterprises, Budget documents. Actual data for 1938-39 and 1946-47 to 1948-49; revised estimates for 1949-50 and 1950-51; estimates for 1951-52. Profits of state enterprises, rough estimates of net income of major enterprises showing profits.

TABLE IV

EXPENDITURES, UNION GOVERNMENT, 1938-39 AND POSTWAR YEARS, CLASSIFIED BY PURPOSE.

(Millions of Rupees)

	1938-39	1946-47	1947-48	1948-49	1949-50	1950-51	1951-52
Current Expenditures:	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
Revenue Collection	10.3	18.8	18.1	12.0	12.7	16.8	20.4
Civil Administration	52.6	108.7	125.8	118.1	110.6	114.8	123.0
Social Development	16.7	46.9	45.0	29.2	33.5	55.7	76.8
Economic Development	13.6	35.2	26.7	15.9	15.1	17.1	30.5
Defense	18.6	40.8	45.9	103.1	122.2	113.5	168.5
Other	30.0	107.1	116.9	64.2	99.4	85.7	132.2
Total Current Expenditures	141.8	357.5	378.4	342.5	393.5	403.1	551.4
Capital Expenditures	16.1	247.1	117.5	65.3	71.1	152.3	270.8
Total	157.9	604.6	495.9	407.8	464.6	555.4	822.2
	(PER CENT OF TOTAL)						
Revenue Collection	6.5	3.1	3.6	2.9	2.7	3.0	2.5
Civil Administration	33.3	18.0	25.4	29.0	23.8	20.6	15.0
Social Development	10.6	7.8	9.0	7.1	7.2	10.0	9.3
Economic Development	8.6	5.8	5.4	3.9	3.3	3.1	3.7
Defense	11.8	6.7	9.3	25.3	26.3	20.4	20.4
Other	19.0	17.7	23.6	15.7	21.4	15.5	16.1
Total Current Expenditures	89.8	59.1	76.3	84.0	84.7	72.6	67.0
Capital Expenditures	10.2	40.9	23.7	16.0	15.3	27.4	33.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: Estimates, based upon Budget data. The Budget data used for 1938-39 and 1946-47 to 1948-49 are actual expenditures; for 1949-50 and 1950-51, revised Budget estimates; for 1951-52, Budget estimates.

3. THE PRESENT REVENUE SYSTEM. Before commenting on tax policies, it may be helpful to present a summary description of the main sources of revenue.

Profits of Government enterprises consist mostly of trading profits of S.A.M.B. These represent in part an absorption by the Government of trading profits formerly gained by private rice traders, but are also due in part to abnormally high world rice prices. High world rice prices result from increased and increasing world demand, and from supply shortages because of abnormal conditions in Korea, Burma and Indo-China.

The only other Government enterprise for which a profit of significant size is expected is the Inland Water Transport Board, with anticipated profits in 1951-52 of one crore of rupees.

Customs, which are expected to yield one-fourth of total revenues in 1951-52 are levied on almost all imports, and on exports of raw jute, jute manufactures, silver and rice. Most import duties are *ad valorem*. Rates between 25% and 35% are common, but rates range from very low percentages up to 90%, the duty on silks. No duty is charged on live animals, grains and pulse, manures, agricultural implements, certain other instruments and items of machinery, and various raw materials for agricultural use or for processing in Burma. The standard rates are not the effective rates in many cases, since a rate of one-half to one-fourth the standard rate may apply to imports from India or Pakistan, and a lesser degree of preference is granted to the United Kingdom. In general, the lower rates apply to consumer necessities, to iron and steel products and to certain other materials used in production in Burma; the higher rates, to non-essentials and to some finished goods which compete with Burmese manufactures. The revenues obtained from import duties equalled about 27% of the value of all imports in 1947-48. In 1948-49, after import restrictions reduced greatly the imports of high duty non-essentials, duties were about 23% of the value of imports.

The export tariffs are specific duties. The only one which is of importance is that on rice. The duty on rice is Rs. 10 per ton—or a little less than 2% of the present world price of rice. The estimated revenue from export duties in 1951-52 is less than 10% of that from the import tariff.

Because the import duties are with a few exceptions *ad valorem*, revenues have gone up sharply as world-wide inflation increased the prices of imports. Some increases in rates of duty have been enacted since the war; these have increased revenues further. In spite of the restrictions now in effect on imports, revenues from import duties in 1951-52 are estimated at Rs. 14.75 crores, almost five times the corresponding 1938-39 revenues of Rs. 3.04 crores.

The next most important group of taxes, in terms of revenue expected in 1951-52, are the sales tax, the excises and the excise duties.

The Burmese sales tax, introduced in 1949, is a "turnover tax", the rate payable being 6¼% (one anna per rupee) of the value of each commodity covered, at each sale as it passes from producer or importer to consumer, except for a selected list of goods on which the tax rate on the first turnover is 12½%. Its estimated yield in 1951-52 is Rs. 3 crores.

Certain goods, mostly essentials such as food, are exempt. Dealers with an annual turnover of less than Rs. 6,000 are exempt. Because of these exemptions, the tax applies mainly to imports. Textiles are taxed at 6¼%, but only at the final turnover, i.e., at retail.

Commodity taxes known as excises and excise duties, have for many years been levied at the point of manufacture on alcoholic beverages; opium and opium derivatives; gasoline and kerosene; silver issued to silver works; sugar, cigarettes, matches and salt. The taxes on alcoholic beverages and opium are known as excises; the others as excise duties. The excises are at high rates, designed to minimize consumption of beer and liquors, and to supplement the direct control of opium use. The excises and excise duties, except on cigarettes, are specific rather than *ad valorem*, all have been raised since the war. Sales taxes, excises and excise duties are scheduled to yield 9% of 1951-52 revenues.

The third largest revenue producer among the taxes at present, and the largest among direct taxes, is the tax on individual and company incomes, which is expected to yield Rs. 47.5 million (4.75 crores), or between 7 and 8% of total revenues. Beginning in 1951-52, the tax will apply to S.A.M.B. and S.T.B., but the fifteen crores of revenue from the Board is classified with Board profits in Table II and is not included in the percentage given above.

Both the tax on individual incomes and that on companies consist of an ordinary or regular tax, whose rates are left unchanged, and a super-tax, whose rates are or may be reconsidered each year when the annual Finance Act is being considered by Parliament. At present, no one with income below Rs. 3500 is liable to tax. Persons with incomes of Rs. 3500 or more pay tax on that part of their incomes above Rs. 1500. The rates of regular plus super-tax combined begin at 15 pies in the rupee, or approximately 7.8%, on income between Rs. 1500 and Rs. 5,000. As income rise above Rs. 5,000, the combined regular plus super-tax rates rise progressively. On income above Rs. 25,000 but not in excess of Rs. 35,000, the rate is 7 annas in the rupee, or 43¾%; on income above Rs. 55,000 but not in excess of Rs. 125,000, 10 annas 6 pies in the rupee, or 65⅝%; and on all income above Rs. 500,000, 15 annas 6 pies, or 96⅞%.

Certain types of income are exempt, e.g., income from life insurance, or from property held in trust for religious or charitable purposes.

Companies pay an ordinary tax of 18.75%, and a super-tax of 31.25%, on all net profits—a total of 50%. Cooperative societies pay 2 annas in the rupee, or 12.5%, on net income above Rs. 25,000.

Before the war, land revenue dominated the tax system, in terms of revenue produced; but in 1951-52 it is expected to yield only half as much revenue as income taxes, or only 3.6% of total revenues.

Land revenues consists of "ordinary" land revenue or land revenue proper, plus fisheries revenue, petroleum royalties, and mining royalties, rents and fees. Before the war it included certain minor household taxes and poll taxes which have now been abolished. Ordinary land revenue yields roughly three-fourths of total land revenue.

Ordinary land revenue is a tax on cultivable land and land which has been shifted from cultivation to other uses. Certain types of land, e.g., dwelling places and lands of religious or educational institutions, are exempt.

In setting the "pitch of assessment", i.e., the rate of land revenue, all of the cultivable land in a given district is divided into three grades. The rate is then set at a given number of rupees per acre; a uniform rate applies to all land in a given grade. The assessment, known as land settlement (i.e., settlement of the rate of land revenue) is made by a painstaking process of investigating the cultivators' costs and revenue, by a trained "settlement party". The settlement party divides the land of the district into the three grades, and for each grade, seeks to determine the "net produce" of a typical cultivator. Net produce, a phrase defined in the law, means in brief gross revenue (including produce retained for home use) minus the cost of labor, materials and maintenance of capital, each computed at the local rate. At one time the cost of family labor was excluded from costs; now it is included, at local labor rates. The pitch of assessment is then decided, in view of the typical "net produce" on each of the three grades of land. Once determined, it is left unchanged until the next land settlement.

A great weakness of the land revenue system is that land settlement is a laborious process, requiring highly trained persons; and, probably for this reason, has been done in each district not oftener than once every twenty years. As a result, regardless of business cycles and wars, inflation and deflation, bringing great changes on costs and revenues, the land tax remains fixed for twenty years.

Land settlement has been conducted in only one of the thirty-six administrative districts of Burma since the War. The recommendations of the settlement party in this one case have not yet been approved. Hence, throughout Burma present rates, in rupees per acre, are identical with prewar rates, even though the price level has risen more than fourfold. No mechanism has existed to adjust them to present conditions.

For this reason, ordinary land revenue would not exceed the prewar total of Rs. 36 to 40 million, even if all land in cultivation before the war were again in culti-

vation and taxes collected. Collection estimates for 1951-52 assume a 50% increase over 1950-51 collections. Even so, the 1951-52 yield would be only 45% of the 1938-39 level. This is testimony to the degree to which insurgency has checked the rehabilitation of land, and prevented collection in large areas now under cultivation. Forest revenues, estimated at 2% of total revenue in 1951-52, consists mainly of royalties paid by private parties and by the State Timber Board. They do not include S.T.B. profits. Because of the increase in timber prices, forest revenue is not far below prewar levels, in spite of the great decline in forest output.

Remaining tax revenues are derived from a group of indirect taxes which together are expected to yield 4% of total revenue. In decreasing order of expected revenue, these are:

State lottery	Rs. 6,300,000
Betting tax	5,800,000
Stamp taxes	4,228,000
Entertainment tax	3,600,000
Business premises tax	1,300,000
Hotel and restaurant tax	1,200,000
Motor vehicles taxes	460,000
Document registration fees	334,000
Total	23,222,000

Miscellaneous non-tax sources of revenue are expected to yield 9% of total revenues, the most important sources being interest on government loans; gross revenue of the posts and telegraph department; and receipts from import licenses. The remainder consists of miscellaneous non-tax revenues of various Government departments and agencies. More than two-third of interest receipts will be from outstanding loans to the Burma Railway Board.

The tax system of Burma as a whole is clearly progressive. Not only do the well-to-do pay more than the poor; as income rises, the tax burden rises more sharply. This is true not only of taxes paid directly by individuals, but also of most of the indirect taxes which in large part are passed on the consumers. In some countries, indirect taxes burden the mass of the people; but those in Burma appear to be levied mainly on goods used much more by the well-to-do and the rich than by the poor.

The most sharply progressive tax is the income tax. The rates on each bracket of income have been stated above. The per cent of total income taken by the tax is, of course, the average of the rates which apply to each bracket. The per cent of total income taken in tax ranges from zero per cent on incomes up to Rs. 3,500, to 85% of income of Rs. 1,000,000 and gradually increasing percentages of higher incomes, up to a theoretical maximum rate of 96⅞%.

The 50% tax on company profits is indirectly related to ability to pay, since company shares are in general held by higher income groups.

Income	*Tax*	*Tax as Percent of Income*
Rs. 3,500 and below	0	0
5,000	273	5.46
10,000	924	9.24
25,000	5,142	20.6
50,000	17,954	35.9
100,000	50,297	50.3
250,000	153,578	61.4
500,000	366,078	73.2
1,000,000	850,453	85.0

Land revenue is in general proportional to income.

Though customs bear upon some imports used largely by low-income groups, in general these goods are exempt or are taxed at a much lower rate than are imports of kinds used primarily by the well-to-do. Similarly, the sales tax exempts a number of commodities which are necessities for the lowest income classes, and thus burdens them much less in relation to their incomes than it does high income groups.

The excises are designed to restrict consumption of alcoholic beverages, without regard for their effects on various income groups. However, since a much greater quantity of liquor is no doubt consumed by well-to-do individuals than by lower-income classes, the excise duties are in general progressive. The rates are much heavier on "hard" liquors than on country spirits.

The excises cover motor spirits and kerosene, silver, cigarettes, sugar, matches and salt. Of these, the last two in particular are essentials for all income groups, and in general, the lower the income of a family, the larger the share of its income which it spends for matches and salt. These taxes, counter to the tendency of the tax system as a whole, are thus "regressive".

The State lottery may or may not be progressive, depending on the degree to which persons in various income classes buy lottery tickets. The betting tax and stamp taxes are clearly progressive. Other sources of tax revenue are small enough so that they do not greatly affect the progressivity of the tax system.

Thus on the whole the tax system is in accord with the principle that the higher-income classes should pay a larger share of their incomes than poorer classes.

Any appraisal of the Government revenue system from any point of view, will not be complete and truly meaningful without considering the trading board profits, especially those of the S.A.M.B. This is not only the principal source of non-tax revenue; it is the major source of Government revenue of any type. The importance of the policies and operations of S.A.M.B. on the economy of Burma, in which the growing of paddy plays such a vital part, is obvious. Its importance in the Government revenue system is equally obvious. Less clear by far are the nature and character of its impact on the country and its people.

There are no reliable data now available on receipts and costs of paddy cultivators. Without such information, there is no basis for judging the economic wisdom of the price which the S.A.M.B. pays for paddy and, therefore, the profits it earns. There are conflicting views as to whether the paddy grower is better off or worse off than before the war. Surely, the paddy grower on the average lives less well than he did before the war but whether the decline in his living standard is more or less than that of other groups is not demonstrable. Evaluation of the S.A.M.B. price policy requires such information.

A thorough study of the economics of paddy growing is sorely needed. It is needed as a basis for determining whether the domestic price of paddy is now a factor in affecting the size of the area under paddy cultivation; how much the grower actually receives for his product and whether Governmental procurement for export can be modified so as to assure a greater income for the cultivator under the present stabilized price; what the aggregate inflationary consequences on the country's economy would be if the Government purchase price of paddy were increased; to what extent the S.A.M.B. profits are derived from its taking over the private traders' margins, from the world inflation of rice prices relative to other prices, or from a shrinkage in the cultivators' real income. Study is also needed of what the outlook is for the world price of rice.

Since S.A.M.B. profits account for such a large portion of total Government revenues, only with the information derived from such a comprehensive study will it be feasible to make comprehensive recommendations on Burma's revenue system. Such a study is strongly recommended.

4. TAX POLICY. Though the revenue system is in general well conceived, it should be examined comprehensively with a view to revisions which may be advantageous. This is true for three reasons:

a. It has not yet been possible to adapt the revenue system fully to present conditions. Prices and production costs within Burma are far above their prewar level. In some areas costs have risen more than prices, in other cases less. With a few exceptions prices are not likely to fall far below their present level, barring a serious worldwide depression. Some prices are more apt to increase than to fall. Taxes must be adapted to this new situation. In part this has been done, but postwar tax revisions were made at a time of an unclear and changing situation, and some present provisions are not fully adjusted to permanent postwar conditions. Some present taxes were introduced to meet a temporary serious emergency in public finances, and need reexamination as permanent measures. No change has yet been made in prewar land revenue rates. Certainly, in view of changes in prices and costs and the paddy price stabilization policy, major change in the land revenue system is necessary.

b. The country is contemplating a development program unparalleled in its history. High public revenues furnish a sound method of financing important sectors of the program. The revenue structure must be geared not only to help provide the necessary financing for the program, but it must consider seriously the deterents and stimuli to various types of economic activity which will be most advantageous to Burma during the development program.

c. Several years of experience has now been gained with the postwar tax structure and its administration. Some of the taxes—the sales tax and other commercial taxes—are new; procedures for administering and enforcing them had to be developed. Other taxes have been greatly changed as to rates and coverages. Customs must be administered in connection with import, export and foreign exchange controls which are entirely new. Now that experience has been gained, a thorough review would almost certainly suggest changes both in the substance of taxes and in administrative methods.

For all of these reasons, a comprehensive review of the revenue system and its administration should be rewarding. The Government has already appointed committees to appraise the structure and administration of commercial taxes, of the income tax, and of customs. The report of the commercial taxes advisory committee is in tentative form. It will be valuable to study the reports of the other two committees. On the basis of these reports and similar analyses of other taxes, the effects of the revenue system as a whole can be critically appraised.

It has not been possible as yet to analyze in any detail the revenue system and its administration. The comments below should be regarded merely as presenting examples of matters to be investigated, and as indications of the need for comprehensive study. Because study of the income tax and its administration is now under way, no suggestions concerning it are presented.

(1) Land Revenue. As has been suggested above, the system of land revenue urgently needs comprehensive investigation.

Here, as in so many other areas, the first need is to restore internal security. Neither rent nor land revenue is being paid in many parts of the Union. But this is only a part of the problem; even in areas where paid, land revenue is still at prewar rates.

The situation is complex, and cannot be remedied by an arbitrary upward revision in the pitch of assessment in ratio to the rise in prices. There is scattered evidence that costs of production for cultivators in many parts of the Delta have increased so much that a considerably smaller

share of the total produce remains for the cultivator than prewar. Moreover, in some areas yields are down. It may be that in parts of the Delta, the net produce is no more, or even less than before the war, and that land revenue rates should not be increased whatever. This may remain true in some paddy areas even after law and order are restored. It is far less likely to be true for land under crops other than paddy.

A Union-wide land resettlement is not a possible solution to the problem for the process would take too long. Only two land settlement teams are now at work. By prewar methods, it requires four years for one team to assess one of the thirty-six administrative districts of the Union. At that pace, for two teams to assess all of the districts would require some seventy years. Even with the most urgent possible action to recruit and train teams, land settlement throughout the Union could not be accomplished by present methods in time to prevent the breakdown of the land revenue system.

In this complex situation, two steps are probably desirable: (a) Emergency action, following reestablishment of security, to bring a speedy even if only partial adjustment of land revenue rates to the postwar situation. Even this emergency adjustment must differentiate between various types of cultivation and various districts of Burma. (b) Development at the earliest possible time of a new permanent basis for land taxation possessing certain features which prewar land settlement lacked:

Land settlement at 20 year intervals caused great injustice and great inequities between individuals and districts, as conditions changed during the 1920's and 1930's. Appraisal of the relative tax-paying ability of various tracts of land must be done far more often than was true prewar. To do so might require equally drastic change in the method of land settlement—either great simplifications of the present process, or adoption of an entirely different method, after investigation of methods of land taxation in other countries. The entire problem urgently needs fundamental study.

Further, the tax *rate* must be subject to adjustment from year to year, as revenue needs vary. In particular, local needs may vary from year to year, and the rate payable for local use must be subject to corresponding variation.

(2) Sales Tax. The sales tax should be retained. It brings in a considerable amount of revenue with only a small cost of collection. It discourages consumption of the goods taxed, and in this way frees resources for use in capital projects, and at the same time brings into the treasury the funds to employ these resources on capital projects.

But on grounds of equity, to remove certain economically undesirable results of the tax, and to greatly lessen evasion, important changes in the structure of the tax are desirable.

(a) The present tax is a turnover tax. There is evidence, both from the judgments of informed individuals and from estimate of the revenue if the tax were fully collected, that there is widespread evasion. This is not due simply to laxity of enforcement; on the contrary, the Commission of Commercial Taxes and his enforcement staff seem to have done an energetic and capable job. In a country like Burma, with many small impermanent traders, many of whom do not keep complete accounting records, considerable evasion of a turnover tax at the various stages between producer and consumer cannot be prevented. Similar evasion of a single-point tax levied at retail is inevitable. Consequently, it is recommended that the present tax be converted into a single-point tax levied at the point of import or manufacture with rates differentiating between various classes of commodities.

Collection at the point of import would be virtually automatic. Evasion at the point of domestic manufacture can be held to a reasonable minimum. The smallest establishments should be exempted, as at present. Even including rather small establishments, there would be relatively few establishments on which to check, and they are more permanently located than are the traders. With a single-point tax levied at point of import or manfacture, collection of different rates on different classes of goods is entirely feasible; if the tax is collected from traders, many of whom handle a considerable variety of goods, enforcement of such differentiation is extremely difficult.

The Commercial Taxes Advisory Committee estimated that a tax at point of import or manufacture with an average rate of 10% would yield as much or more revenue than is now obtained (though perhaps not as much as the present tax would yield after several years of added experience had further improved enforcement). While the exact rate must depend upon economic conditions and revenue needs in the future, these rates could be considered as a point of departure, if conversion is to be made from a turnover tax to a single-point tax.

(b) With a single-point tax levied at the point of import or manufacture, an improved system of differentiated rates for different types of commodities is possible. The Commercial Taxes Advisory Committee has recommended that the following classes of commodities be exempted:

1. Goods that enter into the cost of production in Burma, i.e., raw materials, supplies and capital goods.
2. Goods of which the use should be encouraged for the promotion of health or education; and, most important,

3. Goods that are necessary for the maintenance of an adequate standard of living among the poorest classes.

The purpose of the first proposal is to avoid placing on Burma industries a burden which is not shared by competing industries in other countries. That of the second and third recommendations is obvious. Further, the Committee has recommended that a limited number of commodities which are near-necessities should be taxed at one-half of the standard rate, and that luxuries should be taxed at one and one-half times the standard rate, i.e., at 5% and 15% respectively if the standard rate is 10%.

Both of these proposals are desirable. The list of exempted goods, and those given a preferred rate, should, however, be strictly limited, in view of the advantage to the entire public of maximizing revenue for use in economic development.

The sales tax applies mainly to imports. As long as restriction of imports is necessary, the apparent burden of the sales tax on consumers is in part illusory. Import restrictions create shortages of the goods concerned, and make it possible for traders to charge more than a normal profit. Typically, traders charge "all that the traffic will bear". Wherever this is true, a sales tax which is no greater than the surplus of unearned profit will not raise the price to consumers. It will merely siphon off to the Government part or all of the surplus profit. The shortage situation, and consequent higher prices, constitute a real burden to the consumers, but this burden would exist whether or not the sales tax were levied. Since imports of luxuries, on which a higher sales tax rate is proposed here, are restricted most severely, the degree of shortage and surplus profit is the greatest. The differentiated rate of sales tax is therefore appropriate.

Because of the shortage of foreign exchange, restrictions on imports may have to be continued for as long as the development program is in high gear. But even if they are not, the differentiation of rates makes the sales tax equitable, and the reduction of consumption which it induces is highly desirable so long as the development program makes a high rate of saving and investment, through high Government revenues, desirable.

(3) Excise Duties. Among the excise duties, two levy burdens on the lowest income groups, namely those on salt and on matches. They yield an appreciable amount of revenue, as indicated by the estimated yield of Rs. 5,260,000 in 1951-52. These taxes may be justified on the grounds that a very small participation in the cost of Government, by every income group, is desirable, and that they collect considerable revenue from higher income groups as well. Their desirability or undesirability can be judged only in view of the incidence on various income groups of the entire revenue system.

Some excise duties, such an annual license fees on passenger automobiles—now Rs. 30 per year—might well be increased. A rate differential between automobiles for business use and for pleasure is not practicable. Gasoline and truck taxes should be considered.

The tax of two annas per bank cheque should be repealed because of the great desirability of stimulating the use of this means of payment. The tax is of very little significance as a source of revenue.

(4) Other. Among the commercial taxes, two minor ones, the hotel and restaurant tax, and the business premises tax, should be scrutinized critically because they may act as deterrents to productive enterprises. The hotel and restaurant tax act imposed a tax of 12½% on hotel room rentals and on food sold by hotels, restaurants, bakeries and confectioners. The tax applies twice to food sold to hotels or restaurants by bakeries or confectioners, thus heavily burdening such sales. Whether this rate of tax on the room rental of small hotels and restaurants is equitable is questionable, but there is little reason to question taxation of the few largest establishments, who generally have a higher-income clientele. Changes in this tax seem desirable.

The Business Premise Tax, which like several other postwar taxes, was enacted at the time of the Government's financial difficulties, levies on the occupant of a business premise with annual rental value of Rs. 600 or more (before March, 1950, Rs. 1200) a tax equal to 20% of the rental value.

In the long run—i.e., after existing rental contracts expire and new rent agreements are made, the burden of the tax undoubtedly is borne mainly by the occupier. There appears to be nothing objectionable in principle in this type of tax. However, it was superimposed on several types of license fees, sales tax, business profits tax, etc., on operators of businesses, and rates on property owners. It may unduly burden businessmen. These matters can be judged only after a more comprehensive study of the revenue system as a whole than it has yet been posible to make.

One matter of tax administration deserves comment. The payment of taxes by one Government agency to another results merely in waste effort and expense, without any net gain to the Government. This applies to customs duty on imports for use in public investment, to excises or sales taxes, etc. It is recommended that provision be made for eliminating such payments.

Estimates of project costs throughout this report do not include allowance for customs duty or other taxes on imported capital goods. Addition of such taxes to the cost of public projects would swell the gross cost to the Government, but not the net cost, since a Government agency would receive as well as pay the tax.

It is worth repeating that the suggestions for tax changes and for further investigation which have been made above are by no means complete. The present revenue system was well designed, and has served the Union well in the postwar period; but enough experience has now been gained with that system so that a comprehensive review of it should be fruitful.

B. THE MONEY AND BANKING SYSTEM

Just as the pace of the development program can be accelerated if the fiscal system is functioning with maximum efficiency, so the pace can be faster if the money and banking system is making the maximum possible contribution toward financing Burmese agriculture, industry and trade, and if it is providing the most efficient means of transferring funds and making and receiving payments.

1. THE MONETARY SYSTEM. In a less developed country such as Burma, coin and currency are apt to be a more important medium of exchange than cheques or bank drafts. In prewar years the quantity of currency in circulation was 1½ to 2 times as great as the total of demand and time deposits. Private holdings of money are still greater than private holdings of bank deposits; but the tremendous increase in Government deposits since 1948 has swelled total deposits until they are now considerably in excess of the currency issue.

The value of the rupee is tied to that of other currencies through the pound sterling. Since 1926 or 1927 there has been free convertibility between the rupee and the pound sterling at the fixed rate of one rupee to one shilling six pence, or 13⅓ rupees to one pound.

There is a fiduciary or unbacked currency issue of one hundred million rupees. Any issue of currency above that amount must, under present law, be backed by an equal value of sterling or sterling assets in the possession of the Currency Board. The Currency Board is appointed by the Union Government, but sits in London. Three of its four present members are British.

This survival of British administration is not appropriate to an Independent Burma. It is anomalous that the body controlling the issue of the currency of a sovereign country should not be situated in that country. The issue or retirement of money has essentially the same effects on the economic system as the expansion or contraction of the volume of bank deposits; the regulation of both should be vested in the same body. Equally important, even if a foreign exchange monetary standard is accepted, the issue of money should not be limited to the equivalent amount of foreign exchange deposited with the issuing body. A developing country is apt to need a quantity of currency greater than the amount of foreign exchange it has reason to hold. Further, there may be times when in order to preserve economic stability, the currency issue should expand while foreign exchange holdings are contracting, or *vice versa*.

There is now in draft form a statute which would amend the powers and operations of the Union Bank and vest authority for currency issue and for regulation of bank credit in the Union Bank. This coordination of authority in an instrumentality created by the Government of the Union of Burma is highly desirable. With the changes in the system of money issue proposed in the draft statue, Burma will have a sound system of monetary control.

The principle which should govern regulation of the issue of currency and the creation of deposits is that they should not be checked so long as there is slack in the economy, so that the expansion of either or both may contribute to the financing of an increased level of production and employment; but that an increase in either should be checked by central bank action, if production has reached the practical capacity of the economy. For in this situation further expansion of purchasing power will result only in bidding up prices. When both prices and production are rising, careful judgment by the central bank is necessary.

Economists are coming more and more to agree that only by coincidence will requirement of a fixed minimum reserve against central bank deposits or note issue check expansion at the proper point. The virtue of such a reserve requirement against notes alone or against notes and deposits is that its existence may serve to reassure the banking community, which tends to feel that such a limit increases the soundness of the currency system. If there is to be a reserve limit, it should be set at a level low enough so that it will not interfere with the freedom of the central bank to expand currency and deposits as far as may become necessary to finance expansion of production. On the basis of present foreign exchange holdings, prospective foreign exchange earnings and a practical minimum holding of foreign exchange for emergency purposes, a modest fixed monetary reserve will not, at least in the foreseeable future, interfere with sound money credit control by the Union Bank.

While the units into which money is divided do not affect the soundness of the money system, they do affect its convenience. The adoption of a decimal system, to replace the present divisions of the rupee, would considerably facilitate computation and thereby facilitate business transactions. This change is also a feature of the monetary proposals of the new statute. For simplicity, and to make Burmese monetary and other statistics consistent with practices employed by the rest of world, except India, it would be well if a uniform punctuation of large numbers into thousands, millions, etc., in Government usage replace punctuation into thousands, lakhs, crores, etc.

2. THE BANKING SYSTEM. The banking system

is one inter-related whole, but for convenience various functions may be considered separately.

a. Commercial Banking—the Central Bank. The function of the commercial banking system should be to finance the current (as distinguished from the capital) needs of agriculture, industry, and trade at moderate interest rates; and to serve as a convenient channel of collection and remittance of money within a given community, between localities or regions of the country, and between Burma and foreign countries through a system of demand deposits and the use of cheques. The key and center of this system is the central bank, which must serve as the central clearing house for remittances between banks, must check on the soundness of the loan, investment, and operating policies of the commercial banks, and must regulate money and banking conditions so that the volume of money and credit is appropriate to the current needs of the country. Too low a volume of available credit may cause deflation and unemployment; on the other hand, if there are inflationary pressures in the economy, too high an available quantity of credit will feed inflation.

It was noted above that Government fiscal policy is an important determinant of inflation or deflation. There must be a high degree of cooperation between fiscal and monetary policy, with neither dominating the other.

To carry out its proper functions fully, the central bank must have various powers, most of which the Union Bank of Burma has lacked up to the present time. These powers must include authority to:

(1) Inspect all commercial banks at such intervals as it chooses, to determine that their loans and investments are in accord with principles of safety established by the central bank, and that their banking operations in general are sound and in conformity with law;

(2) Regulate the amount of funds which commercial banks must keep on reserve in the central bank. Variation in this requirement will increase or decrease the freedom of commercial banks with respect to the amounts which they can lend, and will help to keep the volume of credit proportionate to the volume of economic activity.

(3) Lend funds to banks which request it at a time when further extension of bank credit is desirable. This may be done by rediscounting obligations which have been accepted by commercial banks from their customers; by buying certain types of high-grade credit instruments from banks; or by lending to banks on certain other gilt-edged types of security. On the other hand, the central bank should be able to restrict such lending to commercial banks, at times when further extension of bank credit would create excessive demand. The central bank may do so by restricting the type of security which will be acceptable to it for loans, and by increasing the interest rate which will be charged.

(4) Buy or sell securitities on the open market, for the purpose of influencing the lending policies of commercial banks. The central bank should deal only in Government or Government-guaranteed securities. Purchases by the central bank will furnish the sellers with additional funds; as the sellers deposit these funds in their banks, the banks in turn will have additional reserves, and may be induced to lend more freely. Sales by the central bank will draw funds from the buyers. If the buyers pay by cheques on commercial banks (as will usually be true), the central bank by collecting these cheques will reduce the reserves of the commercial banks, and force them to exercise a more restrictive policy with respect to granting loans.

These four powers are the fundamental tools of central bank regulation of credit conditions in any country. In addition, because the dominant commercial banks of Burma are branches of foreign banks, two additional powers are required:

(5) To prevent foreign bank branches in Burma from circumventing credit restriction by the central bank, by obtaining funds from their home offices, as well as to prevent them from transferring funds out of the country, the central bank must have the power to control foreign exchange transactions of all banks.

(6) To insure that branches of foreign banks do not use Burma as a "deposits center", while to a considerable extent their investments are made abroad, the central bank should have the power to require that a minimum ratio of the total assets of a bank or branch in Burma be held in Burmese assets, or that assets of the bank or branch in Burma are above a certain ratio to its liabilities.

Of these six powers, up to the present time, the Union Bank of Burma has been able to exercise only the fifth, control of foreign exchange transactions (except that one loan has been made to a bank on the security of Government securities).

The Union Bank of Burma statute now in force does not give the Union Bank the power to inspect commercial banks, to establish reserve requirements for them, or to set a minimum ratio of their assets in Burma to their total assets, or to their liabilities. The authority to buy and sell Government securities in the open market, which the Union Bank does possess, is not a feasible method of credit control at present, because of the small quantity of Government securities outstanding and the very restricted present market for them. Finally, present statutes governing Union Bank operations, Union Bank officials state, effectively bar the advance of credit to commercial banks by the central banks, even though they are intended to permit such advances. Loans to commercial banks by the central banks, other than loans against Government securities, generally require one or the other of two types of security. One of these is the signature of a bank other than

the borrowing bank, a procedure a commercial bank would normally be very reluctant to follow. The other is the security of a note due to the bank from one of its customers, in connection with which the bank has taken title (i.e., a mortgage) to an adequate stock of goods. Under customary financial practices in Burma and India, a bank making a loan or advance to a customer does not take title to goods as a means of preventing the borrower from disposing of the goods which he offers as security. Instead, the bank takes physical possession of the goods, placing them in a godown (warehouse) under lock and key. The borrower signs a "certificate of hypothecation," which authorizes the bank to take possession of the goods, but does not surrender title to them. Such loans are not available for rediscounting at the central bank. It is said that the requirement for rediscounting now in effect was originally adopted by the Reserve Bank of India, to force banks to adopt the deed of title (i.e., mortgage) form of securing a loan. If the purpose of the requirement was to change commercial bank practices, it failed entirely; its effect, perversely, was to bar commercial banks from obtaining central bank credit.

The new Union Bank draft statute provides for inspection of commercial banks by the Union Bank, for establishment by the Union Bank of minimum asset-liability ratios, and grants the Union Bank authority both to set reserve requirements and to accept as security for loans to commercial banks, loan documents in the form now in use in Burma.

The proposed statute for the first time gives the Union Bank the modern tools of banking control.

b. *Commercial Banking—the Commercial Banks.* The commercial banks of Burma have not performed all of their proper functions fully, both because they have been too few in number and in geographical coverage, and because the scope of their lending activities has been too narrow.

The map inserted at the end of this section indicates the decline in banking facilities since 1941. Even in 1941 facilities were inadequate. In 1941, there were 21 commercial banks in Rangoon, all but three of them branches or offices of foreign banks. Two of them had two offices. In other cities of lower Burma, there were nine banks, bank branches, or bank offices; in upper Burma, six—a total of 38 in the entire country. At present there are only 23 banks, branches and offices in Burma, 18 in Rangoon, 2 in lower Burma, and 3 in upper Burma. Six cities with banking institutions in 1941—Bassein, Henzada, Kyaukpu, Sandoway, Lashio and Myingyan—now have none, while Tavoy, which had no bank in 1941, though it had had one earlier, now has one again. It is clear that Burma is inadequately supplied with banking facilities.

As reconstruction proceeds and business activity increases, the need for banks will become greater. It is encouraging to note that three banks financed from within Burma—two in Rangoon, one in Tavoy—have sprung up since the war. An indigenous bank has operated in Maymyo since before the war. Since the Land Alienation Act prevents an alien from taking title to land or buildings, only Burmese banks can grant loans on the security of real estate mortgages. This should stimulate the development of indigenous banks.

The absence of banks up-country except at the points noted has hampered the growth of indigenous industry and trade, both by preventing the increased use of a system of checks and other credit instruments, and, more important, by depriving local businesses and cultivators access to credit in necessary amounts and at reasonable interest rates. Usurious interest rates have been a very important factor in checking the development of small industry.

Among other effects, the absence of banks has increased the difficulty of inter-community transfers of funds. Where a treasury of the Union Government exists, a transfer order payable by the Union Bank (payable at any other treasury in Burma) may be purchased with currency. A system of telegraphic transfer of funds has recently been instituted between certain treasuries; it will be extended to others. At other points, postoffice money orders must be purchased in order to transfer funds. In many cases, the simplest method available is to send a messenger with currency. Until the collapse of Chettyar activity in the 1930's, demand "hundis" could be obtained from Chettyars in Rangoon payable at almost any town of any importance elsewhere in Burma, or the reverse; and at most centers outside Rangoon, payable at most other centers. No substitute method covering as many points now exists.

The absence of commercial banks in most of the smaller cities and towns of Burma has undoubtedly a number of causes—the lack of interest of many of the foreign banks in the type of banking business which would be appropriate in the interior towns; lack of indigenous capital and of the experience necessary to operate a commercial bank successfully; the great profitability of using one's capital for personal lending, as in sabape loans; the limited volume of potential banking business in smaller towns; lack of public acquaintance with commercial banking facilities and their advantages, as a result of which banking would perhaps not quickly have been profitable even in communities whose volume of business might seem on the surface to justify the establishment of a commercial bank.

As the level of economic activity increases and a larger share of it becomes industrial or commercial, it will be imperative that commercial banking expands in scope, to play its full part in the development. However, it would be undesirable to establish commercial banks in interior

towns before business activity and methods justify them. Failure of banks because of premature establishment would retard the further development of banking. On the other hand, the development of banking will expedite economic development. If indigenous capital does not come forward to establish commercial banks when and where their need is manifest, they should be fostered, perhaps through participation in their financing by the Government, combined with a training program in banking policies and operations.

Not only have the commercial banks failed to expand sufficiently geographically; they have also served too limited functions.

The fact that the branches in Rangoon of large foreign banks are commonly known as "exchange banks" is testimony to the extent to which they have concentrated on the financing of foreign trade. Their business has consisted primarily in financing exports and imports; in lending to the large foreign-owned companies engaged in the extraction of minerals or timber; and in the 1920's, in lending to the Chettyars. The Chettyars, in turn, using primarily their own capital but also some borrowed funds, financed agriculture, but not adequately, as is noted below. Aside from loans to well established foreign enterprises and to Chettyars, in large part the business of the commercial banks has resembled a large-scale pawnshop business, in which they made loans against the physical possession of actual stocks, keeping the stocks under lock and key until the loans were repaid. Making crop or consumption loans to Burmese agriculturists or loans for current purposes to small indigenous industry would have required a close supervision in the field and a knowledge of Burmese practices and enterprises which the banks were unable to acquire or uninterested in acquiring. With very few exceptions, notably Dawson's bank, the large western-type banks had no desire to enter this loan market. As a result, needed capital has been scarce and interest rates high.

c. *Financing Agriculture—Developments to the Present.* The main money lenders to the indigenous population before the Japanese war were the Chettyars. Members of this Indian money lending community extended their operations to lower Burma in the 1850's or earlier, and became increasingly important between 1870 and 1900. In large part they financed the agricultural development of the Delta.

An estimate made in 1929 by the Burma Provincial Banking Enquiry indicates that at that time Chettyars had outstanding some Rs. 650 to 750 million (65 to 75 crores) of loans and advances in Burma. For comparison, total loans and advances in Burma of all of the scheduled commercial banks in 1940-41 were some 5 crores of rupees, or less than one-tenth as great. Between two-thirds and three-fourths of the Chettyar loans were to agriculturists, a considerable fraction to traders, and a small amount to industry or to individuals for personal use. The business of the Chettyars was not limited to lending; they were quasi-bankers, and arranged remittances between cities, accepted deposits, changed money, kept articles in safe-keeping, etc.

The 1929 Banking Enquiry concluded that there was a closeness of cooperation among the Chettyars which kept their interest rates on loans at a level much higher than justified by the risks involved. Interest rates on Chettyars' loans of under Rs. 5,000 in the smaller towns were about as follows:

Security	*Approximate Rate per annum*
Land	15 —18%
Gold or precious jewelry	15 —21%
Other security (e.g., paddy in godown, house in town)	18 —24%
Unsecured promissory note	16½ —21%

These rates were actually for 12 Burmese months, or about 11½ European months. On larger loans, and in Rangoon, rates were slightly lower.

It must not be concluded that these were typical rates of interest. These were the minimum rates prevailing. The Chettyars lent to the individuals among the indigenous population whose credit rating was best, and who could offer the best security. There were many local lenders, doing a considerable volume of business. Their interest rates on loans to persons with less well established credit or poorer security ranged upward to hundreds of percent per annum. At the extreme were the rates on sabape loans (repayable in produce). The cultivator who had exhausted other sources of credit was obliged to promise to deliver paddy (or other crops, in non-paddy areas), at harvest time, at a price per hundred baskets far below the market price, in exchange for a rupee loan of one to six months. The lender was often the miller but might also be the landlord or a local money lender. While the rate of interest on such sabape loans is commonly referred to as 200-300% per annum, figures quoted as common in 1938-39 indicate interest payments on short term loans equivalent to annual rates ranging from 430% to more than 1,000% —the rate increasing as harvest approached and the borrower's need became more desperate. It should be added that sabape loans involve a high degree of risk, being collectible, in many instances, only by being present at the time the paddy is marketed. The losses were no doubt considerable. But with due allowance for the risks, the rates were more than extortionate.

There were two major attempts before World War II to bring money to cultivators at lower interest rates, one private, the other Government-sponsored. The private venture was the establishment of an agricultural bank by Mr. Lawrence Dawson in 1905. At first the sole lending business of Dawson's Bank was to replace existing mort-

gages on agricultural land, by offering to supply at a reduced rate of interest the funds necessary to replace the existing mortgage loan. Its business expanded; and later, when the bank began to supply short-term credit as well, the expansion was even more rapid. The bank flourished through the 1920's, as the data below indicate.

TABLE V

SELECTED DATA, DAWSON'S BANK, 1919, 1924, 1929

(Rs. 1,00,000 may be taken as equal to £7,500)

	1919	1924	1929
Capital	Rs. 4,00,000	5,50,000	7,50,000
Reserves	85,000	2,50,000	7,50,000
Deposits	7,84,438	27,84,227	89,25,428
Investments	2,91,294	8,20,472	28,65,055
Liquid Assets	4,57,886	10,28,910	34,75,007
Advances	8,69,307	26,24,967	70,95,183
Dividends Paid	32,528	61,750	1,06,000
Net Profits	60,516	1,17,554	2,08,116
Dividend Return on Ordinary Shares.	10%	12½%	16%

Though the 75% fall in paddy prices in the early 1930's and the consequent inability of cultivators to pay interest on their loans forced Dawson's Bank to reorganize in 1932, converting its deposits into debentures or preferred shares, it drew on its reserves to pay land revenue on mortgaged land on which the owners could not do so, and to pay interest on debentures. Its income steadily increased so that it was able to pay arrears on the preferred shares, and by 1941 was again paying dividends on ordinary shares.

Its success during the period from 1905 to World War II, which furnishes suggestions for the future, was apparently due mainly to two factors:

(1) It located its branches close to the cultivator, thus making borrowing at moderate interest rates convenient for him.

(2) It trained a field staff both in banking and in paddy agriculture to guide borrowers so that they would use loans wisely for productive purposes.

The second early attempt to reduce interest rates paid by agriculturists was the establishment of agricultural credit cooperatives in 1904. The primary societies were financed in part by share capital, but mainly, in the early stages, directly by the Government. As the system developed, a layer of Central Cooperative Banks was established above the primary societies, and above them, at the apex of the cooperative pyramid, the Burma Provincial Cooperative Bank. There is no need to describe the expansion (1905-1925), decline (1925-1934), and reconstruction (1935-1942) of the cooperative societies. They expanded far faster than did the training of their staffs, and far faster than did understanding of the principles which must underlie successful operation, and by 1925 were characterized by almost every conceivable type of mismanagement. The Government was forced to guarantee deposits (suffering losses of Rs. 3,500,000), and wound up the affairs of the provincial bank, a number of central banks, and many primary societies. Reconstruction was then undertaken. From 1935 on, the activity of the cooperatives expanded gradually; at the beginning of the war they were operating on an apparently quite sound basis but on a greatly reduced scale. Table VI presents data for the years 1923-25 and 1938-40.

During the 1930's, the lending activity of the Chettyars had collapsed to a small fraction of its former volume. Their agricultural loans, like those of Dawson's Bank, nad become largely frozen. They had responded by taking possession of a considerable part of the paddy land in the Delta. In 1929 their assets in Burma consisted of a small amount of cash on hand plus probably between Rs. 650 and Rs. 750 million (65 to 75 crores) of loans and advances; in the late 1930's their cash, loans, and advances totaled perhaps Rs. 100 million (10 crores), and their land holdings Rs. 650 million (65 crores).

At the end of the war, the supply of agricultural credit and other credit in interior towns was so shrunken as to create an almost desperate situation. The Chettyars were too unsure of conditions and had too little liquid funds to revive their lending activity on a large scale. Dawson's Bank likewise was not active in lending. Agricultural co-

TABLE VI

CO-OPERATIVE CREDIT — PRIMARY AGRICULTURAL CREDIT SOCIETIES

(Thousands of Rupees)

	1923	1924	1925	1938	1939	1940
NUMBER EXISTING	4,039	4,097	4,057	1,455	1,513	1,573
Share Capital Paid-up	2,921	3,299	3561	991	803	606
Deposits by Members	161	207	314	146	129	135
Loans from Provincial and Central Banks	10,017	10,787	10,253	1,764	1,703	1,554
Outside Debts i.e. to Government and Non-Members	677	544	491	227	324	351
Loans made During Year:						
To Banks and Societies	85	47	81	14	17	22
To Individuals	7,090	6,599	6,061	530	891	978
Loans Outstanding						
To Banks and Societies	190	100	103	34	30	32
To Individuals	15,035	16,477	16,469	4,614	4,178	3,816
Reserve	2,565	2,934	3,252	2,992	2,478	1,958

operative primary societies were neither numerous enough nor adequately financed or staffed to supply more than a fraction of the funds needed.

Further, new statutes which the Union Government after independence found desirable on other grounds, tended to perpetuate this situation. The Land Alienation Act, which rèndered invalid any future transfers of title of land to aliens, made it impossible for Chettyars, virtually all of whom are non-citizens, to lend on the security of mortgages to land, and so removed the possibility of revival of Chettyar loans. The Rent Restriction Act, by making land ownership by anyone other than the cultivator himself relatively unattractive, made loans by Burmese themselves on the security of mortgages to land relatively unattractive.

Agricultural cooperatives could not safely be expanded rapidly enough to meet the credit need. In these circumstances, the central Government under the postwar British administration, and later the Union Government after independence, greatly expanded direct Government loans to agriculturists under a new law, the Agriculturists' Loans Act. The table below presents data on loans under this Act:

GOVERNMENT ADVANCES TO AND REPAYMENTS FROM CULTIVATORS IN BURMA UNDER AGRICULTURISTS' LOANS ACT

Year	*Disbursements* (Millions of Rupees)	*Repayments*
1945/46	27.8	0.5 *
1946/47	33.7 *	12.1 *
1947/48	27.6	19.6
1948/49	8.1	2.1
1949/50	25.0 RE	15.0 RE
1950/51	25.0 RE	15.0 E
1951/52	30.0 E	15.0 E

* Includes small amounts under other acts

Source: Budget data. 1945-46 to 1948-49, actuals; 1949-50, and 1950-51 disbursements, revised budget estimates; 1950-51 repayments and 1951-52, budget estimates.

It will be noted that disbursements have continued to exceed repayments. In 1950-51, the Government canceled outstanding indebtedness under the Act.

Without these Government loans, production in some areas could hardly have gone on. But these loans have only partially replaced prewar credit sources, which were themselves inadequate. Such scattered evidence as is available suggests that cultivators have found it necessary to seek sabape loans, at ruinous interest rates, for a larger share of their year's needs than before the war. With more experience and with improvement in internal security, loans under the Agricultural Loans Act might go far toward meeting the needs of cultivators. Even so, many other borrowing needs of villagers would remain. And it is questionable whether administration of a loan program by a Governmental department itself under the regulations appropriate to Government operations, can be as flexible in timing, scope of loan, and adaptation to individual need, as could a program administered by an organization, government or private, set up with the administrative structure and methods of operation of a business enterprise.

d. *Financing Indigenous Industry and Trade—the Situation to the Present.* Because agriculture dominates the economy of Burma, it is obvious that conditions in the agricultural loan market determine the conditions in the market for loans to indigenous traders and small industry as well. There is ample evidence that the interest rates which prevail for loans to cultivators also prevail for loans to other individuals in the villages. Even the sabape loans have their counterpart in trade loans to cottage industries. For example, it appears common for merchants to make short-term loans to weavers in return for pledges to sell all output to the lender at prices so much below current market prices that the gain is equivalent to an interest rate of 400-600% per annum. There has been no organized source whatever of long-term or short-term capital loans for trade and small industry.

e. *A Comprehensive Program for Loans in the Villages.* The scarcity of capital in the villages at reasonable loan rates has created a vicious circle which has made it extremely difficult for an enterprising individual to climb the ladder from agricultural worker to renter to landowner. So rapidly does a debt increase, once usurious interest rates begin to be compounded, that one mishap such as the death of a yoke of oxen may start a landowner on an almost certain road to loss of his land. The same exorbitant interest rates have interposed an often insuperable barrier to entry into operation or the expansion of a trading enterprise or a small industrial venture, even though the enterprise was sound under conditions of reasonable loan rates.

Legal prohibition of usurious interest rates will not meet the problem; the high rates result from shortage of capital. As long as the shortage exists, there will still not be enough funds available to meet all needs. Lower interest rates will of course result in larger demands for loans. Indigenous enterprises can be furnished adequate finance only if enough capital can be supplied to meet all prudent demands for loans which will appear when money is available at lower rates.

The problem is not four problems, one in agriculture, one in industry, one in trade, and one in personal finance. It is rather one problem, the problem of village finance. Personal loans, for example, cannot be separated from production loans in agriculture or industry or trade. The process of living until harvest, or until goods are sold, is a part of the process of production; many loans for personal expenses are necessary if production is to go on. Denying credit for prudent personal loans would merely drive the

borrowers to usurious sources which would create a heavy drain on family income and might threaten the soundness of production loans.

Specific and firm recommendations for action to provide adequate credit on a sound basis will require comprehensive investigation. The following are suggestive and deserve thorough consideration:

Establishment of a State Agricultural Bank, whose functions should include administration of agricultural loans.

Expansion of multi-purpose village cooperative societies, to provide, among other services, loans secured on sound cooperative principles for a variety of purposes.

Establishment of state pawnshops to provide single-signature loans for consumer purposes. As indicated above, leaving personal loans open to private lenders able to impose usurious rates may contribute to failure of the other programs. State pawnshops have met this problem successfully elsewhere, notably in Indonesia.

The Agricultural Bank referred to here is not parallel in function to the Industrial Development Corporation and the Mining Development Corporation proposed in Sections VI and VII. The financial problems with which they would be concerned would be mainly those of providing long-term capital. The State Agricultural Bank, as discussed here, would be concerned with shorter-term production loans, ordinarily covering one crop year at most. Its loans might include intermediate term loans for cattle purchase or the financing of fertilizer purchase. If a program were developed for a large-scale capital expenditure such as in the reclamation of land in the Delta which has reverted to jungle, the administrative structure to handle this would need separate consideration.

A commission appointed in 1948 to study the problem of rural finance recommended establishment in 1950 or later of one system of banks encompassing the three proposals listed above. Under this proposal, the Government would sponsor the establishment in each village of a locally managed village bank, to make crop loans on the signature of three cultivators; to furnish the financial basis for multi-purpose cooperative societies, whose functions would include acting as credit cooperatives; to act as a pawnshop, and in other ways to promote village welfare. The village banks would be supervised by district banks, which directly would also administer intermediate term agricultural loans and loans for cattle purchase. At the apex would be the State Agricultural Bank.

As yet neither enough knowledge of the details of this proposal nor of Burmese agriculture and village life has been gained to endorse or express adverse judgment. On the basis of limited observations to date, it is urged that the following principles be applied in considering any course of action:

(1) Agricultural loans can probably be administered more efficiently by an institution set up to operate on the principles of a business enterprise rather than like a Government department. The administrative organization and the methods of operation which are proper for a Government department are quite different from those which are appropriate for either a public or a private business enterprise. In the present case, business-type operation is more apt to be effective. The Bank must be established in the public mind as an enterprise separate from the Government as such, and as a separate enterprise responsible for protecting the integrity of its assets.

(2) A program of agricultural and other business loans must be regarded by the recipients as purely a business-type loan program, in which failure to repay will be followed by penalties including possible loss of loan privileges and foreclosure—though the principle of the program will of course be to avoid either where sympathetic administration of the loan and guidance to the borrower makes it possible to do so. No one must have a "right" to a loan. A loan must not be regarded as a subsidy. A loan must depend upon the personal credit standing of the borrower; the collateral he offers; the production program he proposes, etc.

(3) The loan staff must include local officials in each locality, who are permanent residents of the community, intimately acquainted with local conditions and persons. Such an official can better serve the convenience of the borrowers. He will know how effectively a loan is apt to be used. He must be trained so that he can offer guidance to cultivators in the use of borrowed funds. The experience of Dawson's Bank as well as of rural loan programs in other countries demonstrate the great importance of this aspect.

(4) If an organization with multiple functions is set up, its administration must be so arranged so that responsibility for each function is clearly defined, and the business success or failure of each can be laid directly at the door of one responsible administrative official and the employees operating under his guidance.

The administration of any of the three programs suggested above, or of the related ones included in the 1948 recommendations, requires trained personnel for success. The breakdown of the cooperative movement in the 1920's and 1930's was basically due to its expansion before staff with adequate understanding of the program and adequate training existed. Regardless of the need for speed, it would almost certainly be disastrous to proceed faster than staff can be trained. This injunction applies equally to the agricultural loan program proper; to the establishment of cooperatives; and to the establishment of pawnshops. It

refers not merely to central administrative personnel but with equal importance to villagers operating at the base of the program. Here as in other fields, perhaps the basic obstacle to rapid economic development in Burma is the lack of trained personnel; it would be fatal to attempt to overcome the obstacle by ignoring it. In general, these programs should not be established throughout the country at one time; they should spread geographically as training programs can establish corps of personnel. Speed is urged in getting such training programs under way as soon as the general program is established.

A mission to study the highly successful state pawnshops of Indonesia has already gained some acquaintance with their operation. Initial establishment of only five or six state pawnshops in selected areas should be considered, the establishment of others to be delayed until sufficient experience had been gained so that the nucleus of practical knowledge gained could be used in a training program for operators of added shops. Experimental employment in one or two shops of a financial counselor to advise villagers concerning their financial problems should also be considered.

In considering these programs, it must be recognized that adequate finance is by no means a complete remedy to the problems of agriculture or land ownership in Burma. Many cultivators in the Delta appear to have encountered financial difficulty in part because of inadequate recognition of the financial uncertainties of commercial agriculture. As the Delta was developed, many cultivators seem to have relied typically upon next year's crop and the availability of loans before it matures, and to have spent this year's savings without forethought concerning the cost of the loan which would be needed later, or the disastrous financial situation if some mishap, such as the death of a bullock, should put them deeper into debt at usurious interest rates. Rack-rents—rents beyond the ability of the cultivator to pay—have caused serious financial trouble for cultivators. These rents could not have existed without overeager bidding for land by a large number of would-be cultivators. Their continued existence over many years is evidence that would-be cultivators have bid for land without adequate calculation of their financial prospects as cultivators.

These actions have probably been due mainly to the very high value placed upon status as a cultivator rather than as a laborer, plus the carrying over into lower Burma of patterns of village life which do not recognize the financial risks of commercial agriculture. Unless experience plus programs of education alter these attitudes and bring a concept of agriculture as a business enterprise, the old financial problems are apt to reappear, in spite of the availability of capital at lower rates.

f. *Stimulating Saving and Channeling it into Productive Use.* A country as urgently in need of capital for reconstruction and development as Burma must utilize every avenue of possible increase in the country's savings—and every means available for channeling those savings into productive uses rather than, for example, in the purchase of gold or jewelry. For this reason, educational campaigns should be planned and administrative improvements sought after to popularize the increased use of savings departments of commercial banks, of postal savings banks, and similar institutions; and the use of cooperative societies for the purpose of saving, as well as a place to obtain loans.

However, it should be recognized that the results of such programs will be gradual and long-run. Deep-seated patterns of behavior of villagers include saving in the form of gold or ornaments. Jewelry has a prestige value which is a product of many generations of living habits, and which cannot be weakened quickly by words. Further, the villagers' attitude toward gold or jewelry has a sound economic basis. No other form of savings can as safely be kept on one's person, nor hidden underground or in a basha hut with as little fear of deterioration. To substitute for these values the idea that a paper document granting an abstract right is a desirable thing to hold, either in one's possession or in the safekeeping of a bank or cooperative will take a long time. Yet the campaign should be undertaken to speed the change in saving habits which will in any case emerge as urban and business habits of thought supplement earlier modes of behavior.

C. CONTROLLING FOREIGN MONETARY TRANSACTIONS

The purpose which foreign trade serves is to exchange the commodities which Burma can produce more efficiently than other areas of the world, for the commodities which Burma wants which the rest of the world can produce more efficiently than Burma. In normal times, when there have been no sharp changes in the conditions of demand or supply of goods, this exchange is made most efficiently by permitting importers to buy from abroad whatever they find advantageous, and permitting producers to sell abroad any commodities for which foreign sale is advantageous. But when upheavals in world conditions occur such as those caused by a major war—elimination or reduction for many years of important sources of supply; vast needs for reconstruction; etc.—then the unregulated operation of demand for foreign exchange can be disastrous. The result of free dealing in foreign exchange for Burma in recent years would have been to cause the value of the rupee in relation to other currencies to fall drastically after British support ceased to stabilize it, and thereafter to fluctuate probably by several hundred per cent or more, thus causing the rupee price of imports

and the rupee proceeds from exports to fluctuate correspondingly. Export and import trade would involve such uncertainties as to be similar to gambling. Inflationary and deflationary pressures might strike the country in turn. The well-to-do could continue to buy luxury imports, while the rise in the price of imports caused hardship for the masses. Since Burma does not have the financial resources to stabilize the value of the rupee even temporarily by financial means, controls of the general type of those in force at present were imperative. Such controls are in force in many countries today. They should obviously be continued in Burma.

With foreign exchange controls in effect, the rate of exchange between the rupee and foreign currencies may be set by the Government at any ratio over a considerable range. For some 25 years, the value of the rupee has been tied to that of the pound sterling, at one rupee equals one shilling sixpence. Complex considerations determine the rate of exchange which is most advantageous to a country; the higher the value of the rupee, the cheaper imports will be, and the smaller the proceeds from exports will be. There is no evidence that the present rate of exchange is seriously "out of line" in either direction. Stability in the foreign value of one's money is markedly advantageous. The decision of the Union Government, at its recent entrance into the International Monetary Fund, to continue the present value of the rupee in terms of foreign currencies, seems wise.

Major functions of present controls over foreign exchange and foreign trade are:

a. To prevent the demand for foreign exchange from draining the foreign exchange holdings of the country.

b. To see that goods from abroad most needed in Burma are made available, and that a minimum amount of foreign exchange is spent for non-essential or less essential goods, so that a maximum amount may be available for the purchase of needed capital goods. Achieving this purpose involves both preventing or restricting imports of non-essential or luxury goods, and preventing current exports of essential commodities which may have to be imported later at higher prices.

It should be recognized that the direct postwar controls are superimposed on the customs tariff. By influencing the cost of imports, the tariff influences greatly the pattern of the country's foreign trade.

Burma's trade agreements are not of a nature to alter greatly the composition of her imports and exports, since they do not grant favored import or export tariff rates. They insure a minimum supply of rice to the countries involved, to whom Burma's rice is vitally important, and insure to Burma a minimum supply of several important imports.

The import and export controls and the foreign exchange controls complement and reinforce each other. Only the main features of these controls need be summarized here, for easy reference.

Certain non-essential and luxury imports are completely prohibited. Many essential imports from neighboring countries or from the sterling area, and certain textiles from Japan, may be imported without license (that is, an "Open General License" applies). All other imports require import licenses. In granting licenses, 60% or more of the value of imports in each field is allotted to Burmese nationals, under pledge not to transfer the import permit. Exports of a few goods essential to the domestic economy are prohibited. All other private exports require licenses, which are usually granted as a matter of form if the exporter agrees to surrender the exchange proceeds.

All foreign exchange except minimum working balances of financial institutions is held by the Government, through the agency of the Union Bank. All foreign exchange received by exporters or others must be sold to the Government in exchange for rupees. Foreign exchange to be used for payment of authorized imports is automatically granted. Payments to abroad for so-called "invisibles" require application to the Government for the necessary foreign exchange. Transfers abroad of capital require approval.

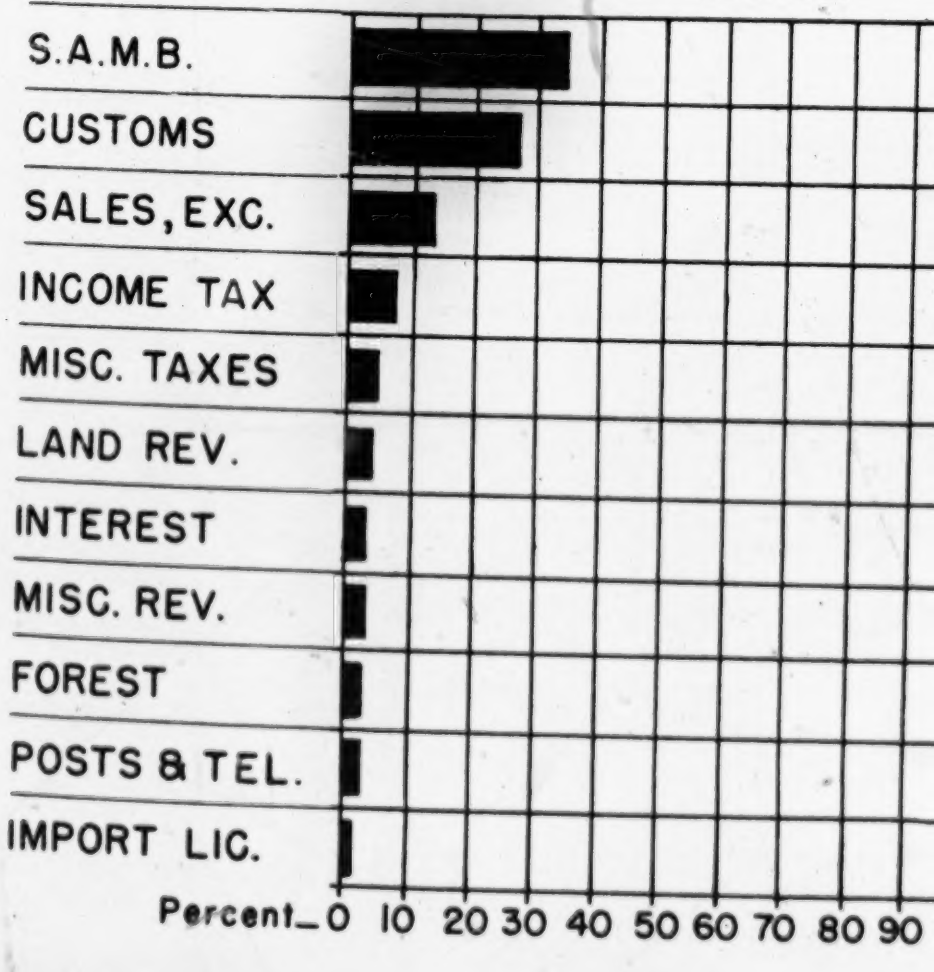
Few substantive recommendations concerning this complex of controls can be offered without intensive study. Thorough consideration should be given to removal of import tariffs on raw materials and capital goods, which increase the cost of production in Burma. The existing tariff schedule does in general contain low rates of duty on many such goods; going farther in this respect would be of some stimulus to production and investment, at the cost of some revenue.

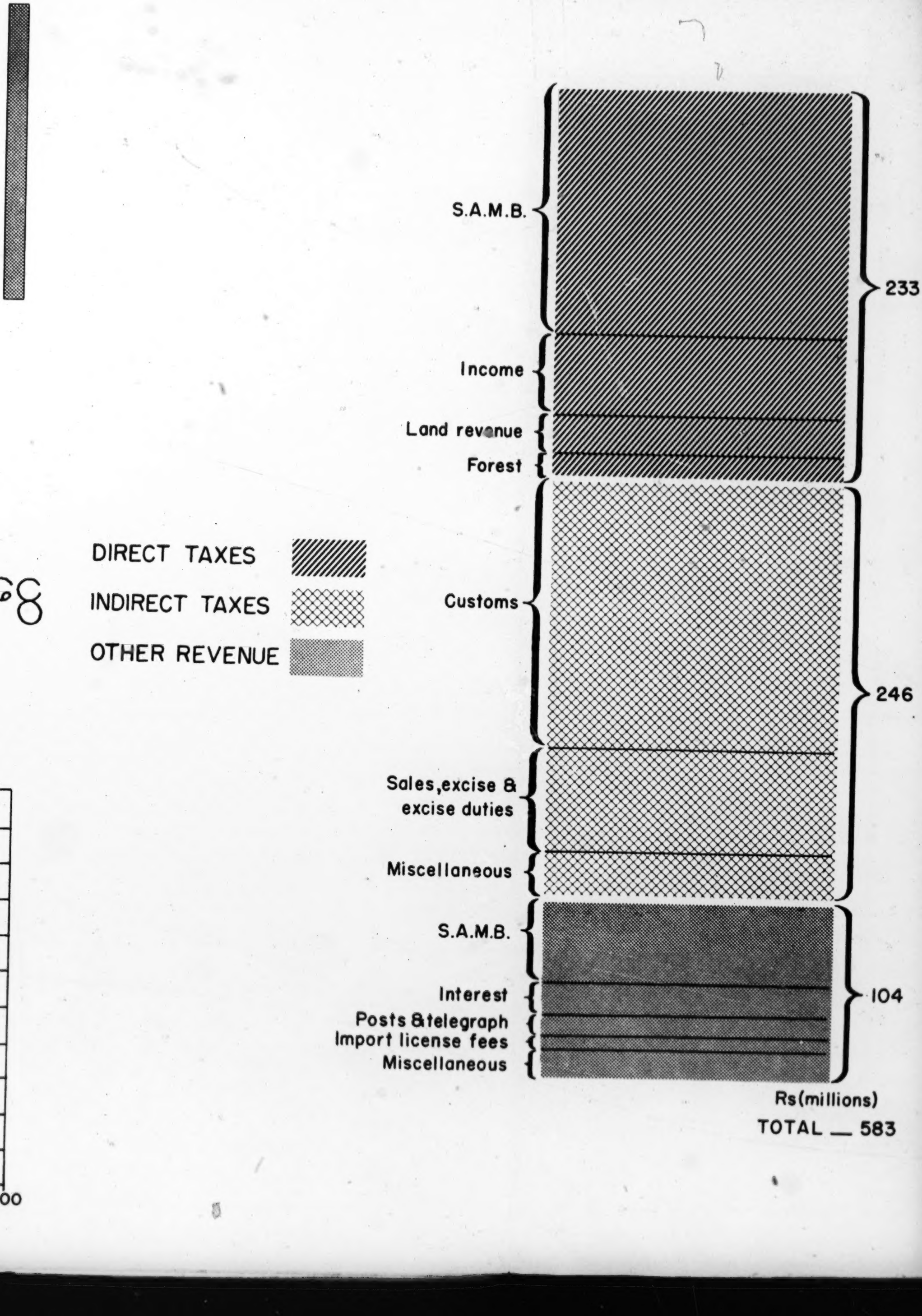
The granting of open general licenses, as contrasted with the granting of import licenses on specific products to specified individuals, has been a subject of considerable controversy. No judgment can be expressed purely on economic grounds. Import licenses are of no advantage to the recipients unless total imports of the commodity are restricted so that a higher price than otherwise can be charged in the domestic market. It is argued that inexperienced Burmese traders must have this advantage, to compete with foreign traders who have well-established connections abroad. If selective licensing can be so administered that it actually results in the permanent establishment of Burmese importers who become efficient traders, then the added cost to the public is balanced by the achieving of this result. If, however, the import li-

ESTIMATED GOVERNMENT REVENUE F.Y.1951-'52

ဘဏ္ဍာ ရေးနှစ် ၁၉၅၁-၅၂ အစိုးရအဆန်တော်ဝင် ခန့်မှန်းငွေ

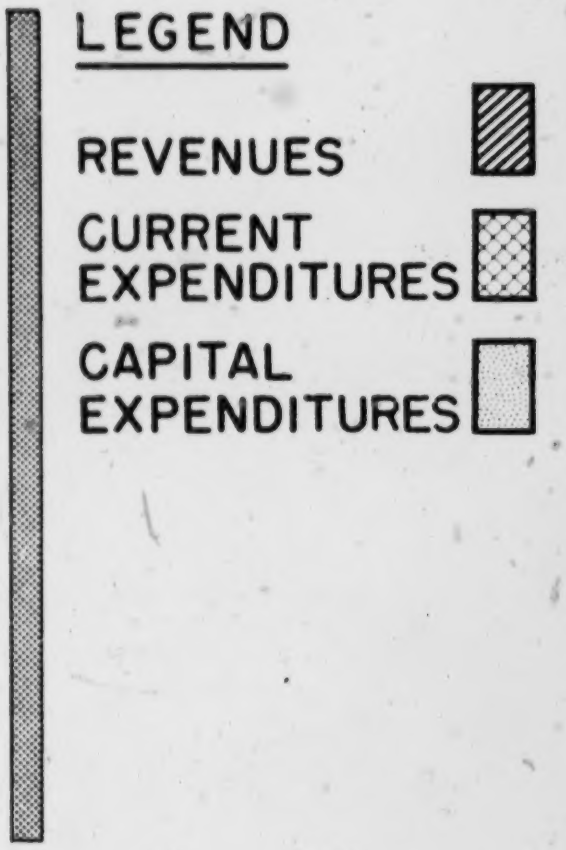
SOURCES OF TOTAL REVENUE

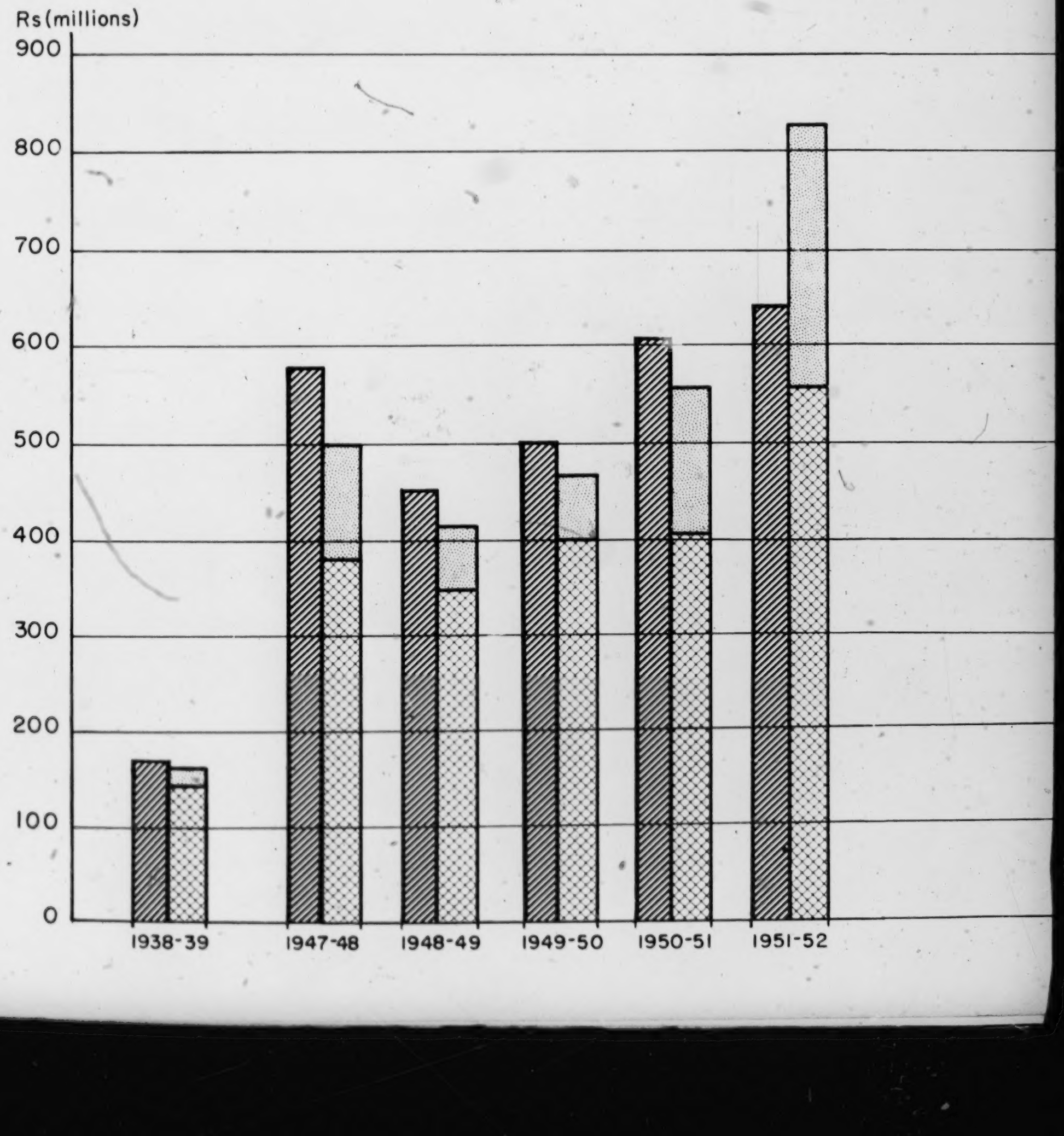



S.A.M.B.
Income
Land revenue
Forest
233
DIRECT TAXES
INDIRECT TAXES
OTHER REVENUE
Customs
Sales, excise & excise duties
Miscellaneous
246
S.A.M.B.
Interest
Posts & telegraph
Import license fees
Miscellaneous
104
Rs (millions)
TOTAL — 583

UNION GOVERNMENT, REVENUES AND DISBURSEMENTS, 1938-39 AND POST WAR

(Revenues Include All Boards Profits. Disbursements Include Both Current and Capital Expenditures)





BURMA

COMMERCIAL BANKING IN BURMA

NUMBER OF BANKS & BRANCHES

LEGEND

1941	1951		1941	1951	
3	1	DECREASE	0	1	INCREASE

TOTALS

37 — 25

92° 93° 94° 95° 96° 97° 99° 100° 101°

28° 27° 26° 25° 24° 23° 22° 21° 20°

Kumjawng Pass · Putao (Fort Hertz) · Chau Kan R. · Tari Wang · Hkading · Magaite · Rang Seng · Hukawng Valley · Triangle · Tsumaw · Shingoo · Hpimaw · Myitkyina · Sadon · Kamaing · Mayaung · Tamanthi · Singkaling Hkamti · Homalin · Lonton · Indawgyi Lake · Sima · Banmauk · Mawlu · Indaw · Shwegu · Bhamo · Katha · Sittaung · Paungbyin · Pinlebu · Mawlaik · Tiddim · Ft. White · Kalemyo · Falam · Haka · Kalewa · Pyingaing · Tamu · Mawlaik · Masein · Kyanhla · Tagaung · Tigyaing · Shweli · Namhkan · Kyu-hkok · SALWEEN · Hsenwi · Hsipaw · Namtu · Mong Mio · Namhsan · Loilem · Lashio · Hsumlong · Meng Lum · Meng Hsaw · WA STATES · Shwebo · Singu · Madaya · Kani · Gangaw · Monywa · Sagaing · Maymyo · MANDALAY · Mongyai · Takuk · Mengma · Mongtung · Mongton · Mongsu · Kehsi Mansam · Mong Nawng · Mong Song · Mong Mao · Mong Lwe · Keng Tung · Loimwe · Mong Yawng · Takaw · Lawksawk · Laihka · Meng Kung · Myingyan · Myingyan · Pakokku · Yesagyo · Myaing · Pauk · Tilin · Yenangyaung · Chauk · Salin · Sale · Meiktila · Thazi · Taungtha · Kalaw · Hopong · Pyawbwe · Yamethin · Mong Nai · Mong Hsat · Mong Pan · Loilem · Kengtung · Sidoktaya · Natmauk · Myothit · Magwe · Minbu · Kyaze · Pinlaung · Loilpul · Mawlamai · Namtok · Sakot · Loikaw · Mong Kyawt · Tsaungdwingyi · Sinbaungwe · Pyinmana · Letthine · Minhla · Gettha · Myohaung · Minbya · Donbaik · Akyab · Kyebon · Ramu · Daletme · Paletwa · Kaladan · Maungdaw · Buthidaung · Kyaukdaw · Nauk · Rathedaung · Sittwe · Harpaelet · Saw · Tagan · Mahlaing · Sakpyu · Chauk · Sale · Salin · Sidoktaya · Yenangyaung · Natmauk · Myothit · Magwe · Minbu · Kyaze · Tsaungdwingyi · Sinbaungwe · Letthine · Minhla · Pyinmana · Loikaw · Loilpul · Mawlamai · Namtok · Sakot · Mong Kyawt · Mong Hsat · Mong Pan · Mong Nai · Takaw · Loilem · Laihka · Lawksawk · Meng Kung · Mong Nawng · Mong Song · Mong Mao · Mong Lwe · Keng Tung · Loimwe · Mong Yawng · Takuk · Mengma · Hopong · Taungtha · Kalaw · Thazi · Meiktila · Yamethin · Pyawbwe · Chauk · Sale · Salin · Sidoktaya · Yenangyaung · Natmauk · Myothit · Magwe · Minbu · Kyaze · Pinlaung

COMMERCIAL BANKING IN BURMA

NUMBER OF BANKS & BRANCHES

LEGEND

1941	1951	DECREASE	1941	1951	INCREASE
3	1		0	1	

TOTALS

1941	1951
37	25

MANDALAY 3 1

RANGOON 24 19

Lashio 1 0

Myitkyina 1 0

Bassein 1 0

Sandoway 1 0

Prome 1 0

Akyab 3 1

Kyaukpyu 1 0

Moulmein 1 1

Tavoy 1 1

Maymyo 1 1

Meiktila 3 1

Shwebo 1 0

Falam 1 0

Ft. White 1 0

Sittaung 1 0

Bhamo 1 0

Namtu 1 0

Loikaw 1 0

Kalemyo 1 0

Mawlaik 1 0

Monywa 1 0

Pakokku 1 0

Thayetmyo 1 0

Henzada 1 0

Tharrawaddy 1 0

Pegu 1 0

Thaton 1 0

Papun 1 0

Mergui 1 0

Amherst 1 0

Kyaukpyu 1 0

Sagaing 1 0

Minbu 1 0

Yamethin 1 0

Taunggy 1 0

Kalaw 1 0

Takaw 1 0

Mong Nai 1 0

Mong Pan 1 0

Mong Hsat 1 0

Mong Kyawt 1 0

Mong Yawng 1 0

Mong Hsu 1 0

Mong Nawng 1 0

Mong Kung 1 0

Mong Song 1 0

Mong Ma 1 0

Mong Lwe 1 0

Mong Hsaw 1 0

Mong Yai 1 0

Mong Pawn

censes are so used as to gain a temporary profit without becoming established as a trader, then there is no public advantage whatever. Whatever the decision may be concerning this matter, it is clear that import licensing, so far as used, should be considered as a temporary policy, used to permit inexperienced traders to gain experience and establish connections with suppliers abroad. No traders should receive a permanent special advantage at the expense of the public.

A thorough review should be made of the administration of foreign exchange and foreign trade controls. There has been considerable complaint concerning the "red tape" and delay encountered in obtaining export and import permits, in clearing goods, etc. Such controls necessarily involve procedures which involve some delay and inconvenience to importers, exporters and other persons involved in foreign exchange transactions. It is important that these delays, and the effort, time and energy involved both on the part of private parties and of Government employees be reduced to a minimum, to free energies for other purposes and to permit trade to be conducted as economically as possible. In setting up a large new program quickly, it is almost inevitable that procedures are adopted which in the light of several years' experience can be simplified without weakening of control. Such possibilities are often seen most clearly by someone familiar with procedures used elsewhere, who approaches the procedures to be revised with expert knowledge but with no judgment concerning them. Hence we recommend that an expert in such controls be assigned to review them and make recommendations for simplification and increase in efficiency, if he regards either as possible.

Burma is a member of the Sterling bloc. Since her foreign trade is predominantly with other countries tied to sterling, and since Britain has agreed to convert into sterling any exchange receipts from Japan, and to furnish exchange for any payments to Japan, continued membership in the sterling bloc is advantageous.

Section IV

AGRICULTURE

A. INTRODUCTION

Burma is preponderantly an agricultural economy. Over 50 per cent of Burma's exports have been from agricultural production and over 65 per cent of the working population of the country have been engaged in agricultural pursuits. Since most of man's resources spring from the soil, it is through his labor and ingenuity in the use of these basic resources that the welfare and wealth of a nation is established. In a country where the chief occupation is working directly in the soil, agricultural development is of profound interest to the people.

Prior to World War II a population of approximately 16,800,000 was supported principally by the production of minor crops and the production and export of rice. The population has presently grown to about 18,500,000 and is constantly increasing. To provide the support for an increasing population at an improved standard of living, agriculture must not only return to the prewar standard but must plan for expansion to keep pace with the growing population. The result of the improvement of farming methods and productivity should be the release of large numbers of workers from agriculture for employment in industry, mining and other activities and allow more time for training and education.

Agriculture studies and projects are in progress by the Special Technical and Economic Mission of E.C.A. Because of this program a comprehensive study of the agricultural resources of Burma was not included as a responsibility of the survey group, however, this survey covers studies and planning for the improvement of the economic welfare of Burma and agriculture, because of its importance to the economy, must be briefly considered.

B. FARM LIFE

1. PAST AND PRESENT. Originally farming was on a family basis and generally of a subsistence peasant economy. Rice monoculture completely transformed this to commercial production for the export market. Rice is grown on 68 per cent of all crop land in the country, in some districts this planting running as high as 95 per cent. Rice farming has set the pattern for the economic structure of agriculture. Generally speaking, small scale cultivation is the rule, a tenant working ten to twenty acres even though the complete holding may be one hundred to one thousand acres. This small acreage is enough to employ one man and a team of cattle.

In "Upper Burma" a large per cent of the landowners farm or cultivate their own land. They are peasant proprietors and their holdings are usually small. Labor for the various operations is provided by the cultivator's own family or through the cooperative assistance of several families or cultivators. A few large holdings have been built up in a family over a long period and these are often farmed by one member as joint property of the owners. Partnership Tenancies, Share Produce Tenancies, Fixed Produce per acre rent and Fixed cash per acre rent have been the usual policy for rental agreement in this area.

In the past, the demands for loans in Upper Burma have not been great because the crops grown there provided for most of the requirements of the cultivator and their families, supplemented by trades for manufactured goods and products from Lower Burma. Although the main crop is rice, farming is more diversified than elsewhere in Burma. The opportunities to mortgage the land to moneylenders were limited because of the natural farming disadvantages resulting from precarious rainfall and crop failures. The farmer looked more to himself for support.

In "Lower Burma" the holdings were generally in large acreages but the landowner was seldom the cultivator nor did he live on the land. Three classes of people were involved in farming, the land owner, the cultivator and

the laborer. The tenants were harassed by the practice of many owners to evict them for a new tenant who would agree to pay higher rent. The result of this competition among tenants is indicated by the following:

50 per cent of the land was held by a tenant for 1 year
17 per cent of the land was held by a tenant for 2 years
8 per cent of the land was held by a tenant for 3 years
25 per cent of the land was held by a tenant for 4 years or more

Rent was fixed in baskets of paddy throughout Burma. Surplus of yield over the cost of cultivation and family support was termed the economic rent. The amount the tenant agreed to pay was termed contract rent. In the bargaining for land, the contract rent too often was raised to the economic rent and thus encroached on the standard of living of the cultivator. Although the Burman is a better cultivator, Indians have increased as tenants because of their lower standard of living. They are, however, in the minority.

Subsistence agriculture as practiced in the past caused no labor problem because the whole family worked on the land. The growth of agriculture for commercial production changed this and the demand for labor was met by importation from India. Initially the farm workers were employed throughout the year, but with the change in agriculture, specialization developed and the laborer was employed to perform certain tasks upon completion of which he was discharged. The cultivator was thus saved the cost of maintaining his laborers between operations and the length of their employment decreased from more than ten months to about six months per year. During periods when work on the farms was not available, work on roads, other public works and in rice mills helped to provide a livelihood for some agricultural employees, however, their standard of living was lowered materially.

2. FUTURE. The present policy of the Government is that of fostering peasant farmer proprietorship under the Land Nationalization Act. A personal interest in the land engendered by proprietorship for long periods will stimulate a willingness to accept improved farming methods and programs and will result in higher standard of living. The "Tenancy Act" is a step forward in the improvement of the rental situation and its successful implementation will go a long way to better the economic life of the Burmese farmer.

In addition to farmer proprietorship and tenancy by rental, the matter of low interest rate loans should be given serious consideration. A system of supervised rural credit has proven successful in other farm situations and should be studied for applicability to the needs of the Burmese farmer. The cultivator would obtain low interest rate loans from this source, for operational expense based on his proposed farm plan or budget. The additional value of supervision and advice received from a trained agricultural manager under such a system would be invaluable in improving farm management and operation.

C. LAND USE AND CLASSIFICATION

1. LAND AREAS. A breakdown of the pre-World War II use of land in Divisional Burma, covering the five year pediod ending June 1940, is shown in Table I. Records of these years are used because they are most indicative of normal conditions. The 170.4 million acres of total area shown by districts in column 5 of the table is classified as to use, with the exception of approximately 66.8 million acres principally in the Chin Hills, Shan States, Kayah State, Naga Hills and Myitkyina for which no record of classification is available. The land uses as classified therein are: Reserve forests, 19.9 million acres (column I); Suitable for agriculture, 40.4 million acres (column 2); not suitable for agriculture, 43.2 million acres (column 3); and not classified, 66.8 million (column 4). The 40.4 million acres of land suitable for agriculture is further divided to show average annual use, i.e., Net acres sown 17.4 million (column 6); acres Fallow 3.8 million (column 7); acres not cultivated 19.2 million (column 8).

The 19.2 million acres suitable for agriculture but not cultivated is unused but assumed to be available for use and the 66.8 million acres not classified is a vast area of land unknown as to amount suitable for cultivation or its productive capacity. Both contain potential areas for expansion of the cultivated acreage in an expanded agricultural program.

In the report, "Land Use and Classification in Burma," by J. T. Sanders and U Ba Tin, the land under cultivation has been graded in terms of persons per acre support in accordance with its productive capacity, as shown by record. By converting production into calories or calory equivalents and allowing approximately 3,000 calories per person per day, the land is graded in accordance with its yield of the crop raised. Calories or calory equivalents for each crop are converted to a rice equivalent on a basis of food value, protein content or price, if the product has no food value. Table II shows major crop acreages and production of each in tons and calories. Table III shows the land grades by districts, computed as described above. The agriculture division of the Special Technical and Economic Mission is now in the process of making studies of the soils in Burma for the purpose of classification. Since these studies have not advanced far enough for use in this report, Table III will be used. The index of population support shown thereon is expressed in the number of persons that an average acre of land, graded as shown, will support and represents the relative population sustaining power of the land. The land

TABLE NO. I

LAND USE AND CLASSIFICATION
(5 Year Average Ending June 30, 1940)

In 1,000 Acres

LOCATION	LAND CLASSIFICATION					SUITABLE FOR AGRICULTURE		
	Reserve Forests 1	Suitable for Agriculture 2	Not Suitable for Agriculture 3	Not Classified 4	Total Area 5	Net Area Sown 6	Area Fallow 7	Area Not Cultivated 8
Akyab	11	2314	1021	—	3346	743	139	1432
Arakan Hills	126	1627	302	—	2055	13	0.5	1614
Kyaukpyu	72	327	2617	—	3016	202	34	91
Sandoway	253	165	2230	—	2648	110	11	44
Pegu	972	1305	353	—	2630	1054	109	142
Tharrawaddy	684	1081	32	—	1797	662	42	377
Hanthawaddy	21	1000	204	7	1232	878	58	64
Insein	295	809	113	—	1217	588	3	218
Prome	668	608	607	—	1883	437	13	158
Taungoo	1014	751	2328	—	4093	539	52	160
Bassein	483	1407	758	—	2648	960	35	412
Henzada	565	891	344	—	1800	728	30	133
Myaungmya	331	1389	110	—	1830	965	29	394
Maubin	—	905	145	—	1050	581	91	233
Pyapon	365	789	219	—	1373	741	20	28
Salween	152	42	1460	—	1654	28	—	14
Thaton	232	2449	438	—	3119	763	66	1620
Amherst	1065	1864	1774	—	4703	594	123	1147
Tavoy	849	1054	1537	—	3440	163	17	874
Mergui	1337	1828	3885	—	7050	164	30	1634
Thayetmyo	457	629	1890	—	2976	237	88	304
Minbu	913	602	750	—	2265	306	176	120
Magwe	361	1335	685	—	2381	643	484	208
Pakokku	815	1310	1409	—	3534	611	247	452
Chin Hills *	—	—	—	6835	6835	—	—	—
Mandalay	497	403	454	—	1354	196	84	123
Kyaukse	237	340	222	—	799	210	65	65
Meiktila	249	931	245	—	1425	471	234	226
Myingyan	32	1346	357	—	1735	782	407	157
Yamethin	947	1406	236	96	2685	485	152	769
Bhamo	409	855	1354	40	2658	39	8	808
Myitkyina	795	1754	6624	9827	19000	117	25	1612
Shwebo	647	1469	1537	1210	4863	774	345	350
Sagaing	Nil	992	198	5	1195	623	228	141
Katha	1640	1069	1520	796	5025	220	25	824
Upper Chindwin	1921	2098	4692	—	8711	134	48	1916
Lower Chindwin	514	1257	570	—	2341	615	299	343
Naga Hills *	—	—	—	6100	6100	—	—	—
North Shan States *	—	—	—	15800	15800	—	—	—
South Shan States *	—	—	—	23250	23250	—	—	—
Kayah *	—	—	—	2880	2880	—	—	—
TOTAL	19929	40401	43220	66846	170396	17376	3817.5	19207
						21193.5		
						40401		

* From Season and Crop Report, June 1948.

grades are grouped into two categories; lands farmed under irrigation and those dry farmed. The grades are in increments of 0.25, starting with Grade 1 as more than 2.0 persons per acre down to Grade 9 with less than 0.25 persons per acre.

Between two and three million acres of rice land has been abandoned during and since World War II because of insecurity, shortage of draft cattle, etc. The recovery and return of this land to cultivation should be the first consideration for increasing the acreage of land in cultivation. Since this report is based on pre-World War II records, the return of this land to cultivation will not increase the total acreage shown in columns 6 and 7 of Table I but it is the first step in increasing the present agricultural output.

In estimating the potential value of the great land pool listed in Table I as "Suitable for Agriculture but not Cultivated", it is estimated that twenty-five per cent of the 19,207,000 acres is suitable for production with a minimum of improvement. Referring to Table III, we find that

over fifty per cent of the land under cultivation is graded 1 to 5, inclusive. Grading the new acreage assumed as productive, in a grade of at least one person per acre support, the addition to the annual yield in terms of rice paddy would be 2,165,000 tons or support for 4,800,000 people. The entire acreage is recommended for study as to its land use and the steps necessary for its inclusion in the cultivation program.

Topography is an important feature of the agricultural land in Burma because of the high acreage of rice which is grown on flat land. Lands topographically suited for agriculture are shown on Map titled "Lands Topographically Suited for Agriculture." The total area is divided to show presently unclassified acreage in the northern part of Burma as "Not Cultivated but Suitable for Agriculture." Data on the productivity of this soil is not available but information indicates the area as reasonably productive with the advantage of being in a good rainfall zone. J. T. Sanders and U Ba Tin, in the report before mentioned, refer to this area as 2,000,000 acres which if half were planted to crops and producing comparable to lands now farmed in Upper Chindwin, Katha, Myitkyina and Bhamo Districts would readily support from 1 to 1.5 persons per crop acre. This potential increase in farm production is 1,500,000 persons support or equivalent rice production of 675,000 tons. The probabilities are that the productivity may be over that suggested. This acreage of new lands should be studied in detail as to land use and the factors involved in placing it under cultivation.

In addition to those lands considered heretofore, it is known that the Shan Plateau area contains unused and underused land resources. Specific data on the acreage of these lands is not available, but it is known that the rainfall is sufficient, the climate favorable and the location suited to the growing of wheat, fruits, potatoes and western vegetables. Assuming that five per cent of the total 39,100,000 acres in the Shan States is planted to these crops with production support of 0.5 persons per cultivated acre, the addition to the agricultural income would be approximately 980,000 persons support or equivalent rice production of 440,000 tons. This area too should be studied in detail for its potential value in an expanded agricultural program.

2. CROPS AND LIVESTOCK. Rice is the main crop and it is grown to some extent in every district in Burma. Groundnuts, Pulses, Millet, Maize and Sesamum are grown mainly in the dry zone and on the poorer grade land. Cotton production of the very short staple variety is centered largely in Myingyan, Meiktila, Sagaing and Thayetmyo districts, rubber in the Tenasserim arm and sugar cane in Pegu, Yamethin and Toungoo districts.

In the consideration of production costs, the question of average yield per acre is an important factor. The following table shows the average yields of rice paddy per acre for countries throughout the world.

YIELDS OF RICE PADDY PER ACRE
(Ave. Bu. 1935-40)

Spain	124.4	United States	49.7
Italy	103.9	Korea	48.6
Australia	98.7	Siam	30.1
Japan	75.4	Burma	27.5
Egypt	68.5	India	26.2
China	52.5	Philippines	22.2

It will be noted that acre yields in the Asiatic exporting countries are low. The high yields, except in Japan, are in countries with a small acreage planted to rice. As the acreage expands, more low producing land is brought under rice until finally sub-marginal lands are cultivated bringing the acreage yield down. Some of Burma's best rice land will yield over 100 bushels per acre. High yields in other countries are also the result of favorable natural conditions combined with efficient methods of farming such as: growing of good strains, effective rotation, use of fertilizer and intensive cultivated methods.

Burma has considerable areas of comparatively intensive crop land use but with a striking underdevelopment in livestock use of areas suited to pastoral enterprises. Future planning should include greater development in livestock especially the hill areas adjacent to the flat lands now in cultivation.

The record of livestock in Burma for the years 1937-38 and 1948-49 is shown in Table IV. Cattle are seldom raised for food although such use of beef was not un-.

TABLE IV
LIVESTOCK IN BURMA

LIVESTOCK	1937-38 (000)	1948-49 (000)
OXEN		
Bulls	686	532
Bullocks	2096	1902
Cows	1430	1221
Young stock	950	853
BUFFALOES		
Bulls & Bullocks	355	254
Cows	397	300
Young stock	266	194
SHEEP	77	24
GOATS	292	177
HORSES & PONIES		
Geldings	20	5
Stallions hired for stud	Less than 1000	Less than 1000
Stallions not hired for stud		1
Mares	23	5
Young stock	6	1
MULES	1	1
DONKEYS	Less than 1000	Less than 1000
PIGS	520	442

(From "Quarterly Bulletin to Statistics," Third Quarter, 1951.)

common. Slaughter of cattle is now prohibited by the Government in order to build up the herds for work animals. Pigs are raised for food but are allowed to run wild and their habits are not conducive to production of a healthful meat. The mortality rate is very high among all livestock and the farmers must frequently import work stock.

One of Burma's large imports is "Bags and Sacks" for the handling of the rice crop. Table V is a tabulation of import and export commodities bearing on agriculture and shows this import. Considerable saving would be realized if the fibres for the manufacture of this commodity were raised in Burma. It would not only furnish a new source of farm income but provide raw material for a new industry. Studies and experiments on fibre crops such as kanaf, abacar, hemp and sisal are recommended. Crops of this type are often grown on hill or semi-marginal land similar to that classified in Table I as "Not Suitable for Agriculture" or some of the land in the hill areas or Shan Plateau not classified. Every indication points to their adaptability to Burma. The raw product value may be estimated as twenty per cent of the total import expenditure. Computing this from the number of "Bags and Sacks" imported in 1938-1939 at the unit price in 1950-1951, the amount is Rs. 21,400,000 from a total of Rs. 107,000,000 expended. Future requirements for bags and sacks based on the recommended increases in production will be much higher.

Vegetable oils are also imported in large quantities. The present production of Groundnut Oil is insufficient for the requirements of the people. A study of the suitability of Safflower as a new crop for vegetable oil from the seed is recommended. It may also be grown as a cover crop and as such planted on lands listed in Table I, column 7, as "Fallow". This practice will serve a two fold purpose; build up the fertility of the soil and increase the production per acre of cultivated land. The plant is easily raised, produces well and is harvested with the same type of equipment used for grain. Reference to Table V shows the potential addition to the income of the country from this production.

In the "Dry Land" area of the Magwe and Mandalay Divisions, are lands with a low population support under present agriculture. Some of this land is in areas proposed for new irrigation development but there are large areas remaining. It is recommended that these areas of low production be studied for the purpose of developing a general trend toward increased livestock raising by either dairy or beef cattle enterprises. Table V shows high imports in "Milk and Milk Products" and "Meat and Meat Preparations". The development in livestock will result in increased income from better utilization of the land and in the production of commodities now imported. The extent to which a program of this kind may be carried is a matter of detailed study but the plan appears feasible and once established would greatly increase the income of the farmer in the area in which the program is carried out.

TABLE V

IMPORT - EXPORT
COMMODITIES BEARING ON AGRICULTURE

PRODUCT	EXPORT QUANTITY 1938-39	EXPORT QUANTITY 1940-41	EXPORT QUANTITY 1950-51	IMPORT QUANTITY 1938-39	IMPORT QUANTITY 1940-41	IMPORT QUANTITY 1950-51
Milk and Milk Products	0	0	0	CWT. 183,000	CWT. 66,000	CWT. 118,800
Sugar and Sugar Preparations	0	0	0	Tons 10,000	Tons 9,000	Approx. Tons 9,000
Fishing Products	0	0	0	CWT. 204,000	CWT. 165,000	CWT. 89,700
Meat and Meat Preparations	0	0	0	CWT. 31,000	CWT. 40,000	Too Small for Record
Groundnut Oil	0	0	0	CWT. 255,000	CWT. 483,000	CWT. 214,000
Cotton Yarn and Thread	0	0	0	LBS. 33,693,000	LBS. 95,524,000	LBS. 16,091,000
Cotton Piece Goods	0	0	0	YDS. 137,611,000	YDS. 173,498,000	YDS. 208,999,000
Raw Cotton	LBS. 38,080,000	LBS. 38,080,000	LBS. 31,229,000	0	0	0
Bags and Sacks	0	0	0	Each 59,218,000	Each 52,363,000	Each 17,217,000
Rubber Manufactures—Import, Raw, Export	LBS. 21,119,000	LBS. 28,456,000	LBS. 18,557,000	Rs. 1,726,000	Rs. 5,416,000	Rs. 7,508,000
Mineral Oil	0	0	0	Gal. 24,759,000	Gal. 21,903,000	Gal. 27,253,000
Rice and Rice Products	Tons 3,228,000	Tons 2,976,000	Tons 1,395,000	0	0	0

(From "Quarterly Bulletin of Statistics" Third Quarter 1951)

D. PRODUCTION.

A study of the production record for all of Burma tabulated in Table II shows the yields to be quite low. Map titled "Population Support" was prepared to show the per acre and total population support from production in each district based on data shown in Table II. It is apparent from a study of this map that in some areas the production is low for adequate support. One of the first programs should be that of increasing production on land that has been under cultivation. The improvement of cultivation practices, planting of improved seeds and use of fertilizer are recommended as means for attaining this end.

1. CULTIVATION PRACTICES. Accounts of cultivation practices in Burma relate principally to growing rice. Since nearly all farmers raise some rice and the only equipment owned is used on operations common to all crops, the cultivation practices over all Burma will be similar. The plow is the most important farm implement, supplemented by the harrow and the hoe. On most farms this plow is very little different from the plow that has been in use in Asia for centuries; it cuts a shallow furrow and has no cutting share or moldboard. Cattle and water buffalo usually provide the power. A team may plow and harrow only 10 to 15 acres a season. The time of plowing under these conditions is governed by the hardness of the soil and usually does not start until the monsoon begins. Seeding is by hand, either by broadcasting the seed or transplanting the nursery plants. Harvesting is performed by hand and threshing is accomplished by use of cattle as has been done for centuries. All these farm procedures are slow and require excessive labor in proportion to acreage cultivated. Because of the equipment used and the cultivation practices followed, it has been impossible to build up the soil by a crop rotation or a green manure program.

Tractors were introduced in 1932 but with almost complete failure because of the swampy conditions during the rains, expense of fuel and inexperience in equipment operation and maintenance. Since that time, many improvements and changes have been made in the tractor and operational tests now being conducted on a number of farms in Burma indicate that they can be used to advantage. The Director of Agriculture has purchased approximately fifty tractors since 1947. These have been placed in localities where their use makes it possible to plow enough in advance of the rains to broadcast the seed after the first showers supply the moisture for germination. The plant is thus assured of a sufficient start to keep ahead of the rising waters.

The crawler or caterpillar tread tractor and the wheel type tractor with special treads can be operated under most adverse conditions and the many sizes in which they are manufactured provides a choice for practically any purpose or situation. Self propelled combine harvesters with caterpillar tread are also manufactured in many sizes. Both the tractor and the harvester would increase production in many ways. The harvester would thresh the grain for immediate marketing or warehousing and at the same time clear the land for immediate plowing before the ground became too hard. The farmer would be free for other pursuits or an expanded farm program. The tractor could pull improved plows of a disk or moldboard type and work the land to better advantage. Its use would speed up the time required to do the operation, allowing the planting of other crops in many cases before the complete loss of the moisture.

Improvements in cultivation practices are certain to increase production. The amount would be difficult to estimate because soils of different fertilities will not respond equally to the same treatment and the cultivators planning and attitude will play a part in the results obtained. As an overall average, a five per cent increase in production from improvements in cultivation practices is believed to be a conservative estimate. This increase, computed on the total production as shown in Table II is 1,108,000 people support or production equal to 500,000 tons of rice. In addition to the increased production, use of equipment will release labor for other pursuits or for farming in areas suggested for cultivation acreage increase. The introduction of mechanized equipment and the planning of its use for improved cultivation practices is recommended, not as an immediate overall reform, but gradually and in designated areas first, for demonstration and test.

2. IMPROVED SEED. There has been little incentive for raising a high quality of rice in Burma. The present milling specification allows up to 40% breakage and any of the rice now grown will meet these specifications. Because of the demand of certain countries there is a market for low grade rice. The European market, however, has been lost to this grade of product.

Attempts have been made in the past to assure the planting of improved rice seed by furnishing the seed to the farmer. At harvest time, the good quality grain is mixed with the poor grain to build up the overall quality and in this manner good seed is lost each year. Prior to World War II development of good seed practices was carried on at an experimental farm in each district but because of war's destruction of equipment, godowns and experimental stations, this effort was curtailed. The present insurgency has made it difficult to return to the pre-World War II status.

The need for planting improved seed for growing rice is clearly indicated. Discussions with farm advisors and agriculturists in Burma indicates that the use of improved

seed should increase yields by ten to fifteen per cent. The full realization of this increase will take about ten years based on observations covering approximately ten per cent of cultivators that are now planting improved seed. The total estimated production increase in rice alone would be an addition to the population support of 2,350,000 people or 1,050,000 tons of rice.

The continued introduction and directed planting of long staple cotton seed and the expansion of sugar cane production will also add to the agricultural income of Burma. Referring again to the record of import and export commodities bearing on agriculture, Table V, a strong import trend in both these products can be seen. Finished products from both crops can be manufactured in Burma, provided the required amounts and quality of raw materials are produced.

The diligent promotion of the planting of improved seeds and strains for all crops in Burma is recommended. Increases in production will not be limited to rice alone but will obtain for any crop to which the program is directed.

3. FERTILIZER. The practice of working the soil in a watered condition and the years of rice monoculture without crop rotation, has depleted most of the soil of vegetable matter and lowered the fertility. In some areas this has been replaced to some extent by flood deposited silt but the bulk of the acreage is in need of fertilizer. This may be a manufactured type or a green crop planted for plowing under, each used at particular times depending on the crop plan.

Published data on rice growing in the monsoon area of Southeast Asia, show decreases in yields where fertilizer is not used and increases in yields where fertilizer is used. The following are comparative records of yields *in pounds per acre*:

USING NO FERTILIZER

Period	*Burma*	*Indo-China*	*Siam*	*India*	*Java*
1910-1915	920	875	928	901	1010
1936-1940	856	571	660	785	892

USING FERTILIZER

Period	*Korea*	*Formosa*	*Japan*	*P. I.*
1910-1915	1052	1100	2030	428
1936-1940	1570	1700	2420	634

The results from the use of fertilizer is clearly indcated in the table. With the exception of Japan whose production is the highest, the increase over a twenty-five year period was over fifty per cent. Commercial fertilizer with a green manure or cover crop program should increase production on low yield land at least forty per cent in a shorter period. Applying this increase to Burma's total production for all crops as recorded in Table II, shows support for 8,850,000 additional people or production equivalent to 4,000,000 tons of rice. The use of fertilizer, both commercial and green manure crop, is recommended to improve farm production in Burma. The length of time required for the full adoption and use throughout the entire farm cultivation program will be dependent on the availability of a commercial fertilizer supply and the speed of its acceptance for use by the farmer.

E. IRRIGATION AND DRAINAGE.

Rainfall is abundant in most of Burma, with the exception of the dry area south and west of Mandalay, which represents about 40 per cent of the total area. All rainfall, however, falls during the months of May to October, inclusive. The dry zone suffers from deficiency of moisture even during the rainy season and during the dry season of November through April; lack of moisture seriously limits production. The average annual rainfall for all areas in Burma is shown on the rainfall map in Section X.

A small per cent of all cultivated land in Burma is under irrigation, as is shown in Table VI, and most of the projects are government-owned. Although irrigation in the dry belt has been practiced for centuries, there are no extensive irrigation projects and the supply of water is generally not dependable because of lack of storage reservoirs. The lower delta produces only one crop because of the lack of irrigation during the dry season.

TABLE VI

CULTIVATED LAND UNDER IRRIGATION
1948

Division	*Total Net Sown and Fallow (000 Acres)*	*Total Land Irrigated In 1948 (000 Acres)*	*Per Cent Of All Cultivated Land Under Irrigation*	*Per Cent of Total Irrigated Land*	*Gov. Owned Irrigation Projects (000 Acres)*
Arakan	1,252	0	—	—	—
Pegu	4,430	74	1.7	5.5	0.6
Irrawaddy	4,180	47	1.1	3.6	—
Tenasserim	1,948	62	0.3	4.7	—
Magwe	2,792	187	6.7	14.1	111
Mandalay	3,086	534	17.2	40.2	345
Sagaing	3,500	423	12.1	31.9	287
All Divisions	21,188	1,327	6.3	100.	743.6

Drainage is important during the monsoon period and also during the irrigation season in the dry belt. High levees thrown up around the low areas hold out the flood waters and in the lower delta, the sea water. From time to time some of these areas are flooded by opening the gates at the upper end of the area and when the water is drawn off, the silt deposit builds up the fertility of the soil.

Referring to Table III, lands listed under "Dry Season Crops" compose 31.7% of all land cultivated in Burma with the production from the areas amounting to only

13.8% of the total production. The table shows that the persons support per acre is low. The land grades from 5 to 9 inclusive with very little land falling in grade 5.

An average of approximately two-thirds of all cultivated land in the Magwe, Mandalay and Sagaing Divisions are sown annually, with one-third left fallow. Of the gross area sown, approximately 13% is abandoned each year because of crop failure. The percentage of fallow and abandonment in these districts is very high as compared with 5% fallow in the Irrawaddy Division and 1 to 2% abandonment in all other divisions. This loss of production from the land use is a tremendous factor in the agricultural economy of the areas mentioned and the country as a whole.

Production increases can be attained by placing more of the land now growing "Dry Crops" under extensive irrigation projects. The following table shows the land status in the Dry Land Crop Area.

TABLE VII

LAND STATUS—DRY AREA

District	*Acres, Irrigated*	*Acres, Dry Crop*	*Acres Suitable for Agriculture Not Cultivated*
Lower Chindwin	110,400	804,300	343,000
Sagaing	55,100	796,500	141,000
Pakokku	116,500	762,600	452,000
Shwebo	626,300	491,400	350,000
Magwe	116,000	1,010,900	208,000
Myingyan	58,200	1,131,200	157,000
Meiktila	20,800	684,400	226,000
Yamethin	302,200	335,400	769,000
Kyaukse	140,200	134,700	65,000
Minbu	150,500	331,600	120,000
	1,698,200	6,483,000	2,831,000

Preliminary studies have been made on several proposed irrigations projects. These are as follows:

Yamethin (Sinthe Project)	78,000 acres
Kyaukse (Myitnge Project)	8,000 acres
Sagaing (pumped irrigation)	200,000 acres
Magwe (Yin and Yan Be Projects)	60,000 acres
Total	346,000 acres

Other projects that appear to have merit are discussed in Section X.

The acreage listed for irrigation under these proposed irrigation projects is conservative, including approximately thirty per cent of the area listed under Dry Land Crops in Table VII. Undoubtedly some acreage now being irrigated from private canals and by other means would be supplied by larger projects thus making the water supply more dependable. As an overall program it would seem safe to consider increased production from the several irrigation proposals as follows:

Construction of the Irrigation Projects for which preliminary studies have been made, would reclassify the land so irrigated into grades based on "Paddy, Garden and Other Irrigated Crops", supporting an average of 1.13 persons per acre instead of the original Grade 8, supporting 0.36 persons per acre. The increase in the economy of the country would be production equal to 104,000 tons of rice or an increase in population support of 230,000 persons.

Construction of additional irrigation projects outlined in Section X would triple the production on the Dry Crop Area irrigated, reduce the fallow acreage and the sown acreage abandoned annually. It is conservatively estimated that thirty per cent of the 6,483,000 acres listed as "Dry Crop Land" in Table VII could be irrigated under these proposed projects, thus 1,945,000 acres would be reclassified to Irrigated Crop Lands. The increase in population support from the original Grade 8 of 0.36 persons per acre to the grade supporting an average of 1.13 persons per acre is a total of 1,500,000 persons or an increase in production equal to 675,000 tons of rice. The reduction of fallow and abandoned acreage each year from the irrigation projects is difficult to determine without more detailed studies but there is little doubt that some reduction will be realized.

It is evident that a liberal use of the available water supplies for irrigation in the lower delta during the dry period would add materially to the welfare of the area through increased production, a wide variety of products for home consumption, more diversified crops and a fuller utilization of labor during the slack periods caused by a one-crop economy. In addition to the irrigation projects proposed heretofore, irrigation by pumping from the streams or shallow wells is recommended in the Delta area below Henzada. This is estimated to cover 4,000,000 acres of the area, making possible a second crop of rapid-growing rice or some of the pulses. Pulses produce heavily under irrigation and would build up the soil. Green manure crops would also be possible under this irrigation and will work with a crop rotation plan.

The increase in production from this proposed project, assuming the grade of the land in persons support of 1.59 to 1.85 per acre, is rice equivalent of 3,100,000 tons or 6,900,000 persons support.

F. AGRICULTURAL PROGRAM.

1. E.C.A. The Agriculture Division of the Special Technical and Economic Mission to Burma has been actively engaged in an agriculture program for Burma. Their objectives are twofold. One is to assist in stabilizing the ecoromy of the country by increasing agricultural production and providing improved facilities for procuring and marketing farm and forest products, and the second is to raise the standard of living of the rural people.

This E.C.A.-assisted agriculture program is made up of projects covering production, marketing and processing of agriculture products. Some are of an emergency nature, and other provide for long-time programs. Practically every phase of production has been covered, and a start has been made in marketing and processing. The projects are as follows:

Processing—
- Shan State Canning Project
- Rice Milling and Processing
- Condensed Milk Production
- Small Scale Sugar Production
- Hand Paper Making
- Textile Weaving
- Sawmilling

Production—
- Classification of Land & Water Resources
- Flood Control in Lower Burma
- Irrigation in Upper Burma
- Soil Conservation in Shan State
- Livestock Disease Control
- Animal Industry in the Shan, Kachin & Kayah States
- Seed Improvement & Distribution
- Cotton Seed Improvement & Distribution
- Insect and Plant Disease Control
- Agriculture Improvement in the Shan State
- Agriculture Improvement in Kayah State

Marketing—
- Rice Storage

In addition to the above projects, three others of a general nature are included:

Extension work—
This project provides for extension work in Divisional Burma. Agriculture Improvement in the Shan State, and Animal Industry in Shan, Kachin & Kayab States includes extension work.

Research—
This project is for the re-equipment of Agricultural Research Laboratories and is of an emergency nature. The Agricultural research is a project of a long-time nature.

Agricultural Education—
This project has been set up for the rehabilitation of the laboratories of the faculty of Agriculture of Rangoon University with the provision of technical assistance through the Fullbright and Point-4 Programs.

The agriculture assistance program is progressing and represents expended and budgeted funds in 1951-52 of $4,739,000.

2. GOVERNMENT ASSISTANCE. In order to assure the success of an expanded and improved agricultural program in Burma, it will be necessary for the Government of Burma to initiate, subsidize and supervise the program. The following recommendations are made for this assistance:

a. Agricultural Extension Work. The present system of agriculture and assistant agriculture officers working under the Deputy Director of Agriculture in each circle should be expanded to include one such officer in each Township. Some of the features of agricultural extension work, as it is carried on through the county agent system in the United States should be adopted. These extension workers would introduce improved methods of farming by getting leading farmers in each community to carry out demonstrations in the use of improved seed, fertilizers, tillage methods, control of insects and plant diseases, and other practices that would make for higher yields and increased income.

The agriculture officers should assist farmers in setting up farming systems adapted to the type of soil and climate under which they are operating. In certain cases it may be necessary to institute programs for moving farmers from sub-marginal land to a higher producing area where there is a surplus of land.

The extension program has many ramifications and will do more than anything else to improve the agriculture of the country.

b. Subsidies. It will be necessary for the Government to subsidize the furnishing of improved seed, fertilizer and farm equipment. Both improved seed and fertilizer would increase the revenue to the Government through the increased and improved product sold on the world market by the Government. The present condition of the farmer makes it impossible for him to increase his expenditures. His condition is such that his income barely provides him living even though neither rents nor taxes have been paid for some time. It is necessary to increase his income by improved methods, reductions in operational costs and increases in production. The Government should purchase mechanical equipment for plowing and harvesting. Both these operations, by use of mechanized equipment, would be speeded up making for more second cropping by more rapid clearance of the first crop from the fields and to the market. Keeping draft stock over long periods for short time operations would be unnecessary. The use of mechanical equipment would lead the way for replacement of existing draft livestock with dairy and beef cattle and improved small farm economy.

c. Warehousing. The provision by the Government of improved warehouses is recommended for the warehousing of farm products of the farmer. These warehouses should be bonded so that the farmer could either borrow on his crop or receive full Government price at the time of warehousing. The Agricultural Division of the Special Technical and Economic Mission has purchased structures for this purpose, expending approximately $800,000 under the ECA program. These are now in the process of delivery and erection.

ESTIMATED CROP ACREAGE, PRODUCTION AND CALORIES PRODUCTION EQUIVAL

FIVE YEARS AVERAGE ENDING JUNE 30, 1940

Acres and Tons in Thousands.
Calories in Thousands of Millions.

LOCATION	RICE			GROUNDNUT			PULSES			SESAMUM			MILLET			MAIZE			COTTON			
	Acres Matured	Tons of Production	Calorie Production	Acres Matured	Tons of Production	Calorie Production	Acres Matured	Tons of Production	Calorie Production	Acres Matured	Tons of Production	Calorie Production	Acres Matured	Tons of Production	Calorie Production	Acres Matured	Tons of Production	Calorie Production	Acres Matured	Tons of Production	Calorie Production	A Ma
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(
Akyab	692.8	452.5	1,104.10	...	...	...	0.8	0.14	0.57	0.6	0.03	0.19	0.1	0.01	0.05	0.4	0.10	0.35	0.8	0.02	0.38	
Arakan Hills	10.4	6.0	14.64	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
Kyaukpyu	180.7	92.2	224.97	...	...	...	...	...	...	0.8	0.04	0.26	...	...	...	...	...	...	...	...	...	
Sandoway	94.5	52.1	127.12	...	...	...	0.2	0.04	0.16	0.4	0.02	0.13	...	...	...	...	...	...	...	...	...	
Pegu	1,013.8	647.9	1,580.88	...	...	...	...	...	...	1.7	0.1	0.65	...	...	...	...	...	...	...	...	...	
Tharrawaddy	570.5	369.6	901.82	...	...	...	10.0	2.1	8.45	2.0	0.1	0.65	...	...	...	4.0	1.0	3.69	...	...	...	
Rangoon	3.2	1.9	4.63	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
Hanthawaddy	816.0	532.6	1,299.54	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
Insein	538.0	267.6	652.94	...	...	...	...	...	...	0.5	0.02	0.13	...	...	...	...	...	...	...	...	...	
Prome	372.5	230.4	562.18	...	...	...	11.9	1.2	4.82	4.2	0.2	1.29	...	...	...	0.9	0.2	0.74	2.7	0.08	1.37	
Toungoo	446.0	245.1	598.04	1.6	0.4	1.74	7.4	1.3	5.23	5.9	0.3	1.94	...	...	...	0.4	0.1	0.37	...	...	...	1
Bassein	881.9	575.1	1,403.24	2.7	0.6	2.62	6.0	1.1	4.42	...	...	...	...	...	...	...	...	...	...	...	...	
Henzada	576.5	357.4	872.06	4.3	1.0	4.36	28.0	4.9	19.70	3.0	0.14	0.70	...	...	...	15.8	3.8	14.02	...	...	...	
Myaungmya	899.2	631.9	1,540.83	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
Maubin	469.0	290.3	708.33	1.7	0.4	1.74	16.9	1.97	7.92	...	...	...	...	...	...	10.6	2.5	9.23	...	...	...	
Pyapôn	722.9	522.4	1,274.66	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
Salween	23.6	11.9	29.04	...	...	...	..	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
Thatôn	673.3	338.7	826.43	...	...	...	3.1	0.54	2.17	2.9	0.17	1.10	...	...	...	0.3	0.07	0.26	...	...	...	
Amherst	495.8	247.5	603.9	...	...	...	0.2	0.04	0.16	4.5	0.2	1.29	...	...	...	...	...	...	...	...	...	
Tavoy	114.5	64.7	157.87	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
Mergui	86.9	42.2	102.97	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
Thayetmyo	87.7	41.6	101.5	...	...	...	...	...	...	68.4	3.4	21.93	...	...	...	...	...	...	53.9	1.8	30.73	
Minbu	139.5	97.8	238.63	...	...	...	56.9	10.0	40.2	54.4	3.1	9.99	31.5	4.5	15.89	18.1	2.3	8.49	1.2	0.03	0.51	
Magwe	78.4	21.6	52.70	170.3	59.0	257.24	21.1	2.8	11.26	181.1	9.3	59.98	...	...	...	33.1	8.5	31.36	...	...	...	
Pakôkku	79.0	26.6	64.90	192.3	42.7	186.17	23.1	3.5	14.07	46.9	1.4	9.03	102.9	12.7	44.83	30.2	5.5	20.30	...	...	...	1
Chin Hills	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
Mandalay	112.0	68.6	167.38	12.0	2.8	12.39	36.2	9.5	38.19	8.1	0.36	2.32	...	...	...	...	...	...	...	...	...	
Kyauksè	132.1	77.3	188.61	...	...	...	26.5	4.7	19.13	41.7	1.9	2.20	...	...	...	...	...	...	...	...	...	
Meiktila	95.1	34.9	85.16	23.3	5.5	23.94	92.0	16.10	64.72	94.8	3.4	21.93	41.3	5.4	20.83	8.4	2.0	7.38	60.5	1.7	29.01	
Myingyan	39.7	12.1	29.62	234.8	38.9	169.60	165.5	19.0	43.64	163.4	5.7	36.76	108.7	11.6	40.94	6.0	1.4	5.17	65.0	2.0	34.14	
Yamèthin	251.6	127.9	312.07	12.4	2.9	12.73	20.0	3.5	14.08	79.5	4.3	27.73	1.3	0.2	0.70	34.8	8.0	29.52	7.8	0.2	3.41	
Bhamo	38.1	17.7	43.19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
Myitkyina	103.8	66.4	162.02	...	...	...	...	...	...	...	...	...	...	...	...	0.8	0.2	0.70	...	...	...	
Shwebo	531.0	254.8	610.70	31.8	7.5	32.56	62.6	11.1	44.62	49.6	2.2	2.90	0.5	0.07	1.25	1.0	0.24	0.89	7.2	0.20	3.41	
Sagaing	40.6	11.9	29.04	32.7	7.7	33.57	187.1	33.5	134.67	86.5	3.7	35.16	31.9	3.9	13.77	1.0	0.3	1.11	114.6	4.2	71.69	
Katha	199.3	110.8	248.20	2.6	0.6	2.60	3.2	0.6	2.4	2.4	0.1	0.60	...	...	...	0.8	0.2	0.70	...	...	...	
Upper Chindwin	111.1	55.4	135.18	...	...	...	8.5	1.5	6.03	0.7	0.03	0.19	...	...	...	1.2	0.29	1.30	...	...	...	
Lower Chindwin	73.9	25.5	62.22	34.6	8.1	35.32	170.0	30.5	122.61	148.7	7.4	47.73	108.8	20.3	71.66	5.6	1.3	4.80	63.2	2.2	37.55	
Naga Hills	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
Northern Shan State	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
Southern Shan State	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
Kayah State	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	
Total ...	11,794.9	7,030.9	17,121.31	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	

This data compiled from report "Land Use and Classification in Burma" by J. T. Sanders ad U Ba Tin; Appendix Tables VIII-XIV inclve. Crop production is converted to c
"Total Calorie Production" includes in addition to those listed, production for areas not lited and double cropping.

G.U.H.C.P.O.—No. 26, 10 of N.P., 9-2-52—200—I.

ESTIMATED CROP ACREAGE, PRODUCTION AND CALORIES PRODUCTION EQUIVALENT

FIVE YEARS AVERAGE ENDING JUNE 30, 1940

TABLE No. II.

Thousands.
ands of Millions.

	GROUNDNUT			PULSES			SESAMUM			MILLET			MAIZE			COTTON			TOBACCO			FRUIT, VEGETABLE AND RUBBER			SUGAR CANE			NOT LISTED	TOTAL		
Calorie Production	Acres Matured	Tons of Production	Calorie Production	Acres Matured	Tons of Production	Calorie Production	Acres Matured	Tons of Production	Calorie Production	Acres Matured	Tons of Production	Calorie Production	Acres Matured	Tons of Production	Calorie Production	Acres Matured	Tons of Production	Calorie Production	Acres Matured	Tons of Production	Calorie Production	Acres Matured	Tons of Production	Calorie Production	Acres Matured	Tons of Production	Calorie Production	Balance net sown over listed	Calorie Production	Net acres sown	Calorie Production
(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)	(27)	(28)	(29)	(30)	(31)	(32)	(33)	(34)	(35)
104.10	...	...	...	0.8	0.14	0.57	0.6	0.03	0.19	0.1	0.01	0.05	0.4	0.10	0.35	0.8	0.02	0.38	1.0	0.45	10.97	21.1	...	100.9	...	...	...	25.3	37.8	742.9	1255.3
14.64	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1.6	0.70	17.07	...	...	...	...	...	...	0.8	2.1	12.8	33.8
224.97	...	...	...	...	...	...	0.8	0.04	0.26	...	...	...	...	...	...	...	...	...	4.0	0.11	2.68	4.9	...	18.3	...	...	...	11.4	5.3	201.8	251.5
127.12	...	...	...	0.2	0.04	0.16	0.4	0.02	0.13	...	...	...	...	...	...	...	...	...	1.3	0.04	0.97	4.7	...	18.96	...	...	...	8.6	12.2	109.7	159.5
1,080.88	...	...	...	...	...	...	1.7	0.1	0.65	...	...	...	...	...	...	...	...	...	4.4	2.0	48.78	20.1	38.5	94.07	...	...	...	14.5	6.3	1054.5	1730.7
901.82	...	...	...	10.0	2.1	8.45	2.0	0.1	0.65	...	...	...	4.0	1.0	3.69	...	...	...	6.2	2.8	68.29	2.28	44.2	108.07	...	...	...	47.3	66.1	642.3	1157.1
4.63	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1.0	...	4.35	...	...	...	0.2	0.4	4.4	9.4
1,299.54	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	28.00	...	133.56	...	...	...	29.5	33.5	873.5	1466.6
652.94	...	...	...	...	...	...	0.5	0.02	0.13	...	...	...	...	...	...	...	...	...	0.2	0.09	2.20	33.9	...	123.06	...	...	...	15.8	4.3	588.4	782.6
562.18	...	...	...	11.9	1.2	4.82	4.2	0.2	1.29	...	...	...	9.9	0.2	0.74	2.7	0.08	1.37	2.4	1.07	26.10	26.7	...	120.95	...	...	...	16.1	19.8	437.4	737.2
598.04	1.6	0.4	1.74	7.4	1.3	5.23	5.9	0.3	1.94	...	...	...	0.4	0.1	0.37	...	...	...	10.9	4.9	119.51	26.7	...	107.33	11.9	14.28	50.98	28.0	48.7	538.8	933.8
1,403.24	2.7	0.6	2.62	6.0	1.1	4.42	...	...	...	...	...	...	...	...	...	...	...	...	4.0	1.8	4.39	42.0	...	201.06	...	...	...	24.1	28.8	960.7	1644.5
872.06	4.3	1.0	4.36	28.0	4.9	19.70	3.0	0.14	0.70	...	...	...	15.8	3.8	14.02	...	...	...	9.6	4.3	104.88	45.6	...	206.57	...	...	...	46.1	70.7	728.9	1293.0
540.83	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	33.5	...	171.86	...	...	...	33.0	61.7	965.7	1774.4
708.33	1.7	0.4	1.74	16.9	1.97	7.92	...	...	...	...	...	...	10.6	2.5	9.23	...	...	...	4.4	1.96	47.80	22.9	...	102.87	...	...	...	56.1	50.8	581.6	928.7
274.66	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	3.5	...	18.48	...	...	...	15.2	20.1	741.6	1313.2
29.04	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	0.7	...	2.58	...	...	...	4.1	4.8	28.4	36.4
826.43	...	...	...	3.1	0.54	2.17	2.9	0.17	1.10	...	...	...	0.3	0.07	0.26	...	...	...	4.2	1.87	45.6	55.4	...	202.76	11.4	13.68	48.84	13.2	12.0	763.8	1139.2
603.9	...	...	...	0.2	0.04	0.16	4.5	0.2	1.29	...	...	...	...	...	...	...	...	...	0.3	0.13	3.17	67.2	...	243.94	...	...	...	26.6	21.9	594.6	874.4
157.87	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	35.6	...	135.64	...	...	...	13.3	27.0	163.4	320.5
102.97	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	0.3	0.13	3.17	61.0	...	215.94	...	...	...	16.1	32.4	164.3	354.5
101.5	...	...	...	...	...	...	68.4	3.4	21.93	...	...	...	...	...	...	53.9	1.8	30.73	5.0	2.23	54.39	4.6	...	16.00	...	...	...	17.2	46.2	236.8	270.8
238.63	...	...	...	56.9	10.0	40.2	54.4	3.1	19.99	31.5	4.5	15.89	18.1	2.3	8.49	1.2	0.03	0.51	2.7	1.20	29.27	3.2	...	6.86	...	...	...	−1.4	20.8	306.1	380.7
52.70	170.3	59.0	257.24	21.1	2.8	11.26	181.1	9.3	59.98	...	...	...	33.1	8.5	31.36	...	...	...	2.7	1.20	29.27	2.3	...	4.48	...	...	...	153.9	211.4	642.9	657.7
64.90	192.3	42.7	186.17	23.1	3.5	14.07	46.9	1.4	9.03	102.9	12.7	44.83	30.2	5.5	20.30	...	...	...	10.3	4.6	112.19	2.0	...	4.92	...	...	...	124.4	64.4	611.1	520.8
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
167.38	12.0	2.8	12.39	36.2	9.5	38.19	8.1	0.36	2.32	...	...	...	...	...	...	...	...	...	4.3	1.9	46.58	11.4	...	51.3	...	...	...	11.8	31.6	195.8	349.8
188.61	...	...	...	26.5	4.7	19.13	41.7	1.9	12.20	...	...	...	...	...	...	...	...	...	6.6	2.9	70.73	18.1	...	76.56	1.0	1.2	4.28	−16.1	2.8	209.9	374.3
85.16	23.3	5.5	23.94	92.0	16.10	64.72	94.8	3.4	21.93	41.3	5.4	20.83	8.4	2.0	7.38	60.5	1.7	29.01	...	...	...	8.9	...	23.76	...	...	...	46.9	6.3	471.2	283.0
29.62	234.8	38.9	169.60	165.5	19.0	43.64	163.4	5.7	36.76	108.7	11.6	40.94	6.0	1.4	5.17	65.0	2.0	34.14	0.9	4.9	119.51	8.3	...	18.43	...	...	...	− 9.9	29.8	782.4	527.5
312.07	12.4	2.9	12.73	20.0	3.5	14.08	79.5	4.3	27.73	1.3	0.2	0.70	34.8	8.0	29.52	7.8	0.2	3.41	1.1	0.5	12.19	12.1	...	45.01	19.8	23.8	84.97	45.2	78.2	485.6	620.6
43.19	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	0.2	0.09	2.20	0.3	...	1.01	...	...	...	0.4	4.56	39.0	50.96
162.02	...	...	...	...	...	...	...	...	...	...	...	...	0.8	0.2	0.70	...	...	...	0.5	0.2	5.40	1.7	...	7.96	7.9	9.5	33.92	2.3	3.1	117.0	213.10
810.70	31.8	7.5	32.56	62.6	11.1	44.62	49.6	2.2	12.90	0.5	0.07	1.25	1.0	0.24	0.89	7.2	0.20	3.41	0.7	0.32	7.80	9.3	...	32.09	...	...	...	81.0	22.93	774.7	769.2
329.04	32.7	7.7	33.57	187.1	33.5	134.67	86.5	3.7	25.16	31.9	3.9	13.77	1.0	0.3	1.11	114.6	4.2	71.69	6.4	2.9	70.73	5.2	...	11.08	...	...	...	117.6	1.24	623.6	392.06
248.20	2.6	0.6	2.60	3.2	0.6	2.4	2.4	0.1	0.60	...	...	...	0.8	0.2	0.70	...	...	...	1.4	0.6	14.6	2.4	...	8.92	...	...	...	8.1	1.71	220.2	279.8
135.18	...	...	...	8.5	1.5	6.03	0.7	0.03	0.19	...	...	...	1.2	0.29	1.30	...	...	...	0.9	0.4	9.8	0.2	...	0.73	...	...	...	11.8	6.4	134.4	159.6
762.22	34.6	8.1	35.32	170.0	30.5	122.61	148.7	7.4	47.73	108.8	20.3	71.66	5.6	1.3	4.80	63.2	2.2	37.55	2.3	1.03	25.12	6.5	...	16.38	...	...	...	2.1	6.4	615.7	429.8
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
21.31	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	17,365.9	24,476.1

rom report "Land Use and Classification in Burma" by J. T. Sanders and U Ba Tin; Appendix Tables VIII-XIV inclve. Crop production is converted to calories or calorie equivalent, the equivalent based on comparative values.
action" includes in addition to those listed, production for areas not listed and double cropping.

LAND GRADES BASED ON POPULATION SUPPORT

(NET SOWN AND FALLOW ACREAGE ONLY)

TABLE No. III.

In 1,000 acres.

LOCATION	GRADES BASED ON PADDY, GARDEN AND OTHER IRRIGATED CROPS									GRADES BASED ON DRY SEASON (DRY LAND) CROPS						TOTAL, ALL GRADES
	1	2	3	4	5	6	7	8	Total	5	6	7	8	9	Total	
Akyab	...	...	423.0	...	344.0	115.0	...	...	882.0	...	...	...	...	...	...	882.0
Arakan Hills	11.0	...	...	2.0	...	...	...	...	13.0	...	...	...	...	...	...	13.0
Kyaukpyu	...	...	...	66.0	...	71.0	99.0	...	236.0	...	...	...	...	...	...	236.0
Sandoway	...	...	35.0	...	48.0	...	38.0	...	121.0	...	...	...	...	...	...	121.0
Pegu	...	...	535.2	395.6	...	232.7	...	...	1,163.5	...	...	...	...	...	...	1,163.5
Tharrawaddy	...	...	542.7	133.9	28.2	...	...	...	704.8	...	...	...	...	...	...	704.8
Hanthawaddy	...	...	391.2	400.6	...	139.7	...	...	931.5	...	...	...	...	...	...	931.5
Insein	...	...	...	178.8	220.4	195.6	...	...	594.8	...	...	...	...	...	...	594.8
Prome	...	153.1	...	166.7	...	130.6	...	...	450.4	...	...	...	...	...	...	450.4
Toungoo	...	189.1	...	242.2	159.5	...	...	...	590.8	...	...	...	...	...	...	590.8
Bassein	...	378.0	...	387.9	228.8	...	...	...	994.7	...	...	...	...	...	...	994.7
Henzada	...	258.0	...	296.0	204.9	...	...	...	758.9	...	...	...	...	...	...	758.9
Myaungmya	298.4	...	467.5	...	...	228.8	...	...	994.7	...	...	...	...	...	...	994.7
Maubin	...	...	235.4	...	269.0	168.2	...	...	672.6	...	...	...	...	...	...	672.6
Pyapôn	...	281.8	243.7	236.1	...	...	...	...	761.6	...	...	...	...	...	...	761.6
Salween	...	...	...	...	21.0	7.7	...	...	28.7	...	...	...	...	...	...	28.7
Thatôn	...	...	364.1	...	339.3	124.1	...	...	827.5	...	...	...	...	...	...	827.5
Amherst	...	122.0	...	208.1	...	387.6	...	...	717.7	...	...	...	...	...	...	717.7
Tavoy	52.3	...	57.8	...	70.4	...	...	...	180.5	...	...	...	...	...	...	180.5
Mergui	41.0	74.2	...	...	80.0	...	...	...	195.2	...	...	...	...	...	...	195.2
Thayetmyo	...	...	...	...	29.3	44.6	53.4	...	127.3	7.9	120.5	69.1	...	...	197.5	324.8
Minbu	...	63.2	...	51.2	36.1	...	...	...	150.5	...	...	96.2	152.5	82.9	331.6	482.1
Magwe	...	...	...	...	...	...	17.4	98.6	116.0	...	121.3	323.5	566.1	...	1,010.9	1,126.9
Pakôkku	...	...	...	...	21.0	21.0	43.0	31.5	116.5	...	91.5	228.8	442.3	...	762.6	879.1
Chin Hills	Not Graded															
Mandalay	46.9	...	...	53.1	23.4	...	...	...	123.4	51.6	...	29.2	15.6	...	96.4	219.8
Kyauksè	53.3	...	60.3	...	26.6	...	...	...	140.2	...	44.4	76.8	13.5	...	134.7	274.9
Meiktila	...	...	...	...	20.8	...	...	...	20.8	...	83.2	...	198.4	402.8	684.4	705.2
Myingyan	...	...	...	...	11.1	...	47.1	...	58.2	...	...	181.0	950.2	...	1,131.2	1,189.4
Yamèthin	...	...	...	...	136.0	136.0	30.2	...	302.2	...	80.5	254.9	...	...	335.4	637.6
Bhamo	...	...	...	...	16.0	...	21.6	9.4	47.0	...	...	...	...	...	...	47.0
Myitkyina	...	48.3	...	...	65.3	28.4	...	...	142.0	...	...	...	...	...	...	142.0
Shwebo	...	...	...	...	163.4	295.3	169.6	...	628.3	...	...	...	117.9	373.5	491.4	1,119.7
Sagaing	...	...	...	...	...	21.5	22.6	11.0	55.1	...	...	143.4	653.1	...	796.5	851.6
Katha	...	...	...	83.4	...	112.8	49.0	...	245.2	...	...	...	...	...	...	245.2
Upper Chindwin	...	...	...	...	80.3	...	102.1	...	182.4	...	...	...	...	...	...	182.4
Lower Chindwin	...	...	...	...	12.1	...	42.0	56.3	110.4	...	80.4	...	723.9	...	804.3	914.7
Naga Hills	Not Graded															
Northern Shan States ...	Not Graded															
Southern Shan States ...	Not Graded															
Kayah	Not Graded															
Total of Graded Area ...	502.9	1,567.7	3,355.9	2,901.6	2,654.9	2,460.6	735.0	206.8	14,385.4	59.5	621.8	1,402.9	3,833.5	859.2	6,776.9	21,162.3
Percentage of all Graded Land	2.1	8.2	16.4	13.6	12.3	11.6	3.4	0.7	68.3	0.3	2.9	6.4	18.0	4.1	31.7	100
Percentage of all Production ...	5.2	13.0	24.1	17.2	13.8	10.3	2.6	...	86.2	0.3	2.5	4.1	6.1	0.8	13.8	100
Average Support in persons/acre	2.21	1.85	1.59	1.35	1.13	0.91	0.65	0.45	...	1.03	0.86	0.69	0.36	0.22	...	...
Support in 1,000 persons ...	1,110	2,900	5,330	3,915	3,000	2,240	478	93	19,066	61	535	940	1,360	189	3,085	22,151

Compiled from report "Land Use and Classification in Burma" by J. T. Sanders and U Ba Tin.

The analysis of grades of land is based entirely on three grades of "Paddy" land and three grades of "Dry Crop" land, as used in the Settlement Reports.

G.U.B.C.P.O.—No. 27, Min. of N.P., 5-2-52—200—I

BURMA

LANDS TOPOGRAPHICALLY SUITED TO AGRICULTURE

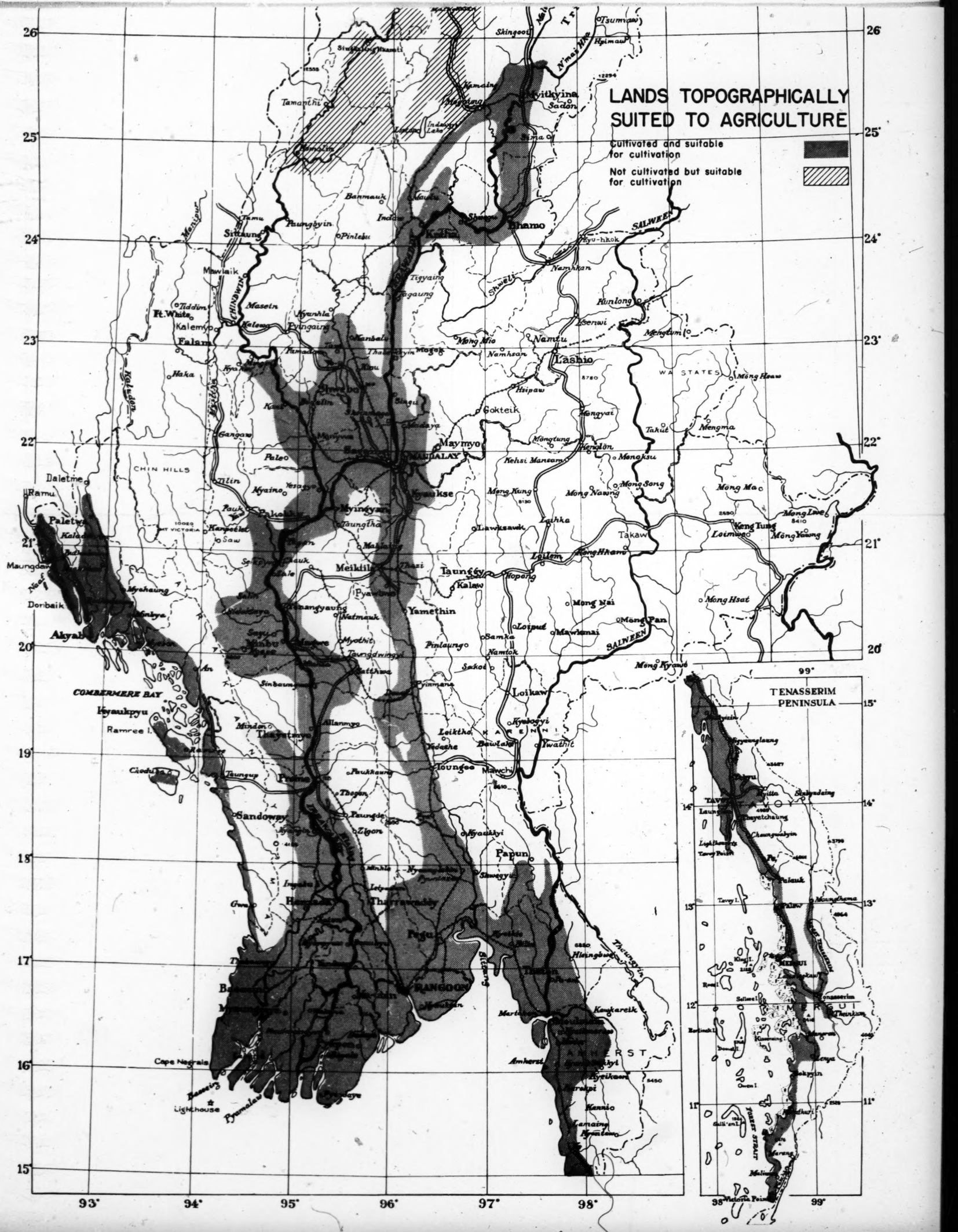
Cultivated and suitable for cultivation

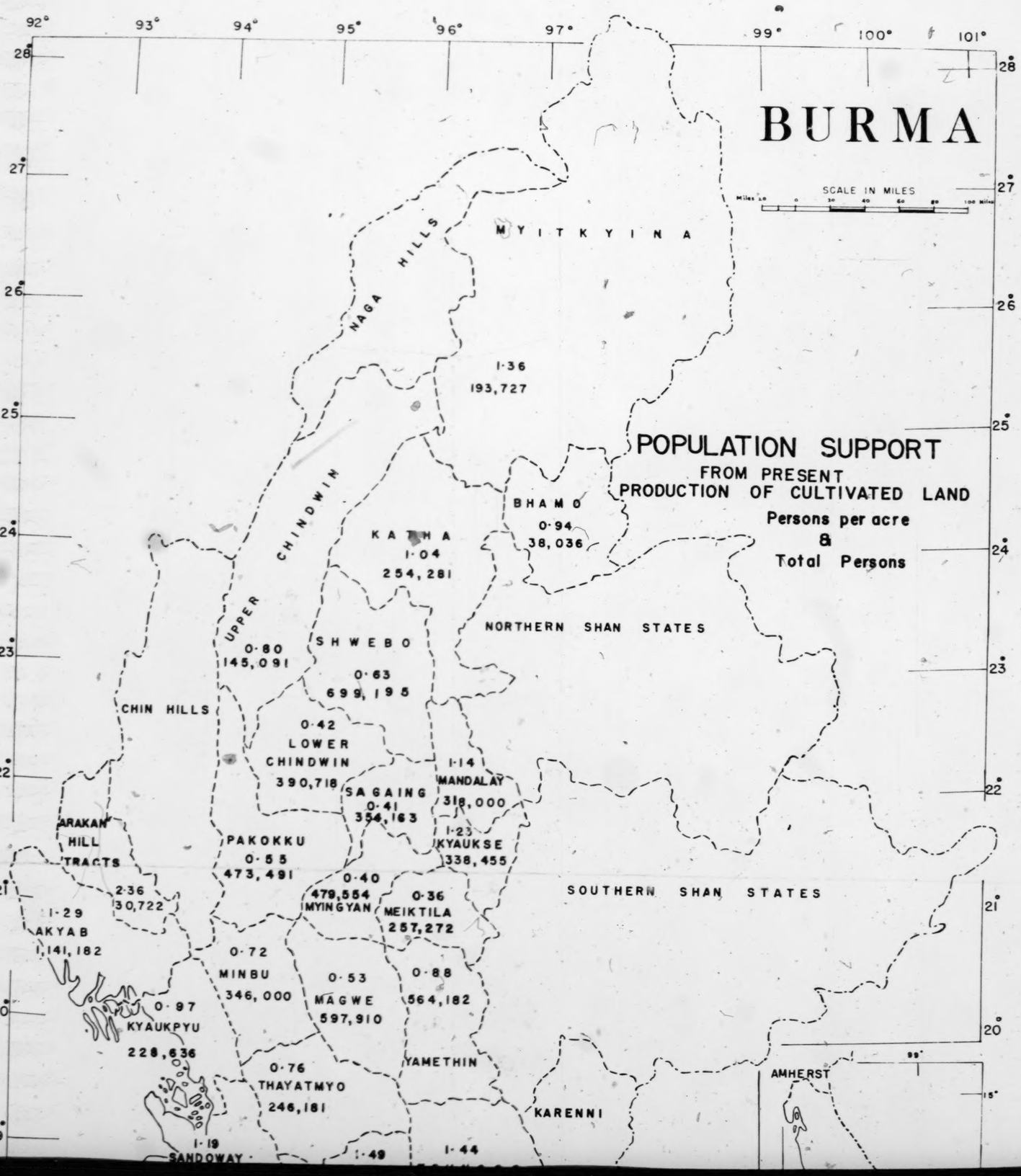
Not cultivated but suitable for cultivation

92° 93° 94° 95° 96° 97° 99° 100° 101°

28° 27° 26° 25° 24° 23° 22° 21° 20° 15°

Kumjawng Pass
Tari Wang
Pahpi (Fort Hertz)
Chau Kan
Kwing
Mogaita
Hoding
Rang Seng
Hukawng Valley
Chanyee
Sumprabum
Mali Hka
Triangle
Tsumwan
Hpimaw
Shingoot
N'mai Hka
Kamaing
Mogaung
Myitkyina
Sadon
Tamanthi
Indawgyi Lake
Sima
Banmauk
Indaw
Shwebo
Tamu
Paungbyin
Pinlebu
Sittaung
Monywa
Mawlaik
Chindwin
Tiddim
Ft. White
Kalemyo
Falam
Masein
Kyanhla
Pyingaing
Kalewa
Haka
Kabaw Valley
Gangaw
Myaing
Pale
CHIN HILLS
Tilin
Daletme
Ramu
Paletwa
Kaladan
Mount Victoria
Saw
Maungdaw
Donbaik
Akyab
Myebaung
Minbya
Mayu R.
COMBERMERE BAY
Kyaukpyu
Ramree I.
Sinbaung
Thandwe
Meiktila
Myingyan
Taungtha
Pauk
Yenangyaung
Natmauk
Myothit
Taunggwingyi
Pyawbwe
Yamethin
Pinlaung
Sakot
Kyimana
Thazi
Taunggyi
Kalaw
Hopeng
Loilem
Mong Hkam
Lawksawk
Laikha
Takaw
Mong Nai
Loiput
Mawkmai
Mong Pan
Samka
Namtok
Loikaw
Kyebogyi
Loikha
KAREN
Maymyo
MANDALAY
Kehsi Mansam
Mongkse
Mong Kung
Mong Nawng
Mongtung
Hengdon
Mongksu
Mong Song
Mong Ma
Mong Lwe
Keng Tung
Mong Yawng
Leimong
Mong Hsat
Mong Kyawt
Kengtawng
Namhkan
Shweli
Namtu
Lashio
Namhsan
Mong Mio
Hsipaw
Gokteik
Tengyai
Takut
Mengma
Mong Hsaw
WA STATES
Kunlong
Eserwi
Mongtum
Namkok
SALWEEN
Shamo
Kyu-hkok
TENASSERIM PENINSULA
Miles 20 0 20 40 60 80 100 Miles


LANDS TOPOGRAPHICALLY SUITED TO AGRICULTURE
Cultivated and suitable for cultivation
Not cultivated but suitable for cultivation
TENASSERIM PENINSULA
WA STATES
CHIN HILLS
COMBERMERE BAY
AMHERST
MERGUI
Myitkyina
Bhamo
Lashio
Namtu
Maymyo
Meiktila
Yamethin
Loikaw
Papun
Pegu
RANGOON
Sandoway
Akyab
Mandalay
Tavoy
Mergui
Victoria Peak
Cape Negrais
Lighthouse
SALWEEN
SITTANG
IRRAWADDY
CHINDWIN
Tsumao
Hpimaw
Sadon
Kyu-hkok
Hsipaw
Takaw
Mong Nai
Mong Pan
Mong Hsat
Mong Kyawt
Mong Yawng
Mong Mao
Mong Nawng
Mong Kung
Mong Hsu
Mong Hsaw
Mong Song
Mong Ma
Mong Lwe
Keng Tung
Loimwe
Takaw
Lawksawk
Laihka
Loilem
Hopong
Kalaw
Taunggyi
Pinlaung
Namtok
Sakot
Loikaw
Loikto
Kyebogyi
Thayetmyo
Prome
Henzada
Thayetmyo
Toungoo
Shwegyin
Kyaukkyi
Kawkareik
Thaungyin
Hlaingbwe
Martaban
Amherst
Kyaikkami
Kanaing
Kyaikkwe
Tenasserim
Moungdhema
Palauk
Thayetchaung
Chaungzubyin
Kyaikto
Sinbaung
Myothit
Watmauk
Meiktila
Myingyan
Pakokku
Yenangyaung
Yenangyat
Minbu
Myaing
Myohaung
Paletwa
Ramree I.
Cheduba I.
Maungdaw
Doribaik
Ramu
Daletme
Tiddim
Ft. White
Kalemyo
Falam
Haka
Gangaw
Paleo
Tilin
Myaing
Yesagyo
Pauk
Kanpetlet
Saw
Mwelaik
Kyauksa
Kyaukse
Singu
Mogok
Thabeikkyin
Manbalu
Kyaukme
Hsenwi
Mehgtum
Namhkan
Namhsan
Mong Mio
Tigyaing
Tigaung
Shwebo
Monywa
Kalewa
Indaw
Banmauk
Pinlebu
Sittaung
Thamu
Kalemyo
Kalewa
Pyingaing
Kyunhla
Masein
Tamanthi
Hkamaing
Mogaung
Indawgyi Lake
Shingeou
Nmai Hka
Mali
T'ai
Hkamti
Singkaling
Homalin
Tamu
Paungbyin
Indaw
Kawlin
Shwebo
Kanbalu
Ye-u
Kyaukse
Myingyan
Taungtha
Meiktila
Thazi
Pyawbwe
Yamethin
Watmauk
Myothit
Taungdwingyi
Letpadan
Sinbaung
Prome
Paukkaung
Thegon
Paungde
Zigon
Kyaukkyi
Shwegyin
Thanlyin
Hlaingbwe
Thaungyin
Martaban
Kyaikto


BURMA
SCALE IN MILES
POPULATION SUPPORT
FROM PRESENT
PRODUCTION OF CULTIVATED LAND
Persons per acre
&
Total Persons
92°
93°
94°
95°
96°
97°
99°
100°
101°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
HILLS
NAGA
MYITKYINA
1·36
193,727
BHAMO
0·94
38,036
KATHA
1·04
254,281
UPPER
CHINDWIN
NORTHERN SHAN STATES
0·80
145,091
SHWEBO
0·63
699,195
CHIN HILLS
0·42
LOWER
CHINDWIN
390,718
1·14
MANDALAY
318,000
SAGAING
0·41
354,163
1·23
KYAUKSE
338,455
ARAKAN
HILL
TRACTS
2·36
30,722
PAKOKKU
0·55
473,491
0·40
479,554
MYINGYAN
0·36
MEIKTILA
257,272
SOUTHERN SHAN STATES
1·29
AKYAB
1,141,182
0·72
MINBU
346,000
0·53
MAGWE
597,910
0·88
564,182
0·97
KYAUKPYU
228,636
YAMETHIN
0·76
THAYATMYO
246,181
KARENNI
AMHERST
1·19
SANDOWAY
1·49
1·44

POPULATION SUPPORT

FROM PRESENT
PRODUCTION OF CULTIVATED LAND

Persons per acre
&
Total Persons

MYITKYINA

1·36
193,727

NAGA HILLS

UPPER CHINDWIN

0·80
145,091

BHAMO
0·94
38,036

KATHA
1·04
254,281

NORTHERN SHAN STATES

SHWEBO
0·63
699,195

CHIN HILLS

0·42
LOWER CHINDWIN
390,718

1·14
MANDALAY
318,000

SAGAING
0·41
354,163

1·23
KYAUKSE
338,455

ARAKAN HILL TRACTS

2·36
30,722

PAKOKKU
0·55
473,491

0·40
479,554
MYINGYAN

0·36
MEIKTILA
257,272

SOUTHERN SHAN STATES

1·29
AKYAB
1,141,182

0·72
MINBU
346,000

0·53
MAGWE
597,910

0·88
564,182

0·97
KYAUKPYU
228,636

YAMETHIN

0·76
THAYATMYO
246,181

KARENNI

1·19
SANDOWAY
48,000

1·49
PROME
670,000

1·44
TOUNGOO
848,528

1,051,091
THARRAWADDY

1·49

1·55
HENZADA
175,454

1·35
PEGU
1,573,364

1·15
SALWEEN
33,109

1·50
BASSEIN
1,495,000

1·20
INSEIN
711,454

1·25
THATON
1,035,600

1·25
MAUBIN
844,272

1·43
1,333,333
HANTHAWADDY

1·62
1,613,090
MYAUNGMYA

1·57
PYAPON
1,193,818

1·11
AMHERST
794,873

AMHERST

1·75
TAVOY
291,363

1·65
MERGUI
322,227

26°
25°
24°
23°
22°
21°
20°
19°
18°
17°
16°
15°
14°
13°
12°
11°
93°
94°
95°
96°
97°
98°
99°

G. SUMMARY.

The possibilities for an improved economy through the advance of agriculture in Burma are very great. The recommendations as presented in this report are suggested for a long range agriculture program, and the increases in production and income from the fulfillment of the various proposals are reasonable estimates.

1. RECOMMENDATIONS. Diligent procedure in the administration of the "Land Nationalization Act" and the "Tenancy Act".

Establishment of a system of supervised rural credit whereby the farmer could obtain low interest rate loans for operational expenses.

Expansion of the cultivated acreage by placing a portion of land suitable for agriculture but not cultivated, and lands not classified in North Burma and the Shan States, into cultivation.

Addition of new crops for fibres and vegetable oils to replace the imports in commodities from these products and establish livestock enterprises in areas of Burma with a low population support.

Improvement in production and farm efficiency by improving cultivation practices through the use of mechanized equipment.

Improvement in production by the planting of improved seeds.

Improvement in production by the use of commercial fertilizer, planting of green manure crops and crop rotation.

Increase in production and land use by irrigation from various recommended projects such as: projects in the preliminary study stage in the dry area totaling 298,000 acres, new projects proposed in the dry area totaling 1,945,000 acres, and a pump irrigation project on 4,000,000 acres in the lower delta area for second crop or crop rotation.

Government assistance in the purchase of improved seed, fertilizer, warehousing facilities and mechanized equipment and the establishing of more farm advisors or extension agents and experimental farms.

The complete areial photo coverage of the agricultural lands of the country. These photos will be used for computation of acreages in all phases of the program and the study, design and determination of extent of irrigation and drainage projects. The photography is recommended for immediate action so that the studies under the various recommendations may start without delay.

2. ESTIMATE OF RESULTS. A summary of some of the possible increases in production from the recommendations proposed is as follows:

Proposed Recommendations	*In Thousands* Cultivated Acres, Increase or Equivalent	Production Increase, Tons of Rice Equivalent	Agriculture Income Increase in Equivalent Rupees
LAND USE & CLASSIFICATION:			
Acreage Increases from Lands "Suitable for Agriculture but not Cultivated"	4,800	2,165	324,750
Acreage Increase from Lands in North Burma not now classified	1,000	675	101,250
Acreage in Shan States now now Classified	1,955	440	66,000
Addition of Fibre Crops Production	246*	142.5	21,400
Addition of New Vegetable Oil Producing Crops	Values not estimated		
Establishing of Livestock Enterprices	Values not estimated		
PRODUCTION:			
Improvement in Cultivation Practices	860*	500	75,000
Use of Fertilizer	6,900*	4,000	600,000
Planting of Improved Seeds	1,810*	1,050	157,500
IRRIGATION & DRAINAGE:			
New Irrigation Projects now in Preliminary Study Stage	179*	104	15,600
New Irrigation Projects—			
New Proposals	1,160*	675	101,250
Dry Season Irrigation Delta Area..	5,350*	3,100	465,000
Total	24,260	12,851.5	1,927,750

*Acreage increase based on yield of 1,300 lbs. of rice paddy per acre.

Note: Agriculture Income increase based on rice paddy at Rs. 150 per Ton.

Section V

FORESTRY

A. GENERAL.

It is not within the purview of this survey to investigate and recommend a change in forest administration, conservation and extraction for Burma since work in this field has been undertaken and a report submitted by the United Nations Food and Agriculture Organization under the supervision of Dr. J. A. Von Monroy, Forest Industry Expert, assisted by a Committee and seven subcommittees composed of specialists of the Ministry of Agriculture and Forestry. However, because of the importance of forest products to Burma's foreign trade, industry, and housing it seems advisable to consider briefly in this report the general aspects of forestry, with regard to its place in the economic development of the country. From 1937 to 1940, forestry contributed about 9 per cent to the revenue receipts of the Government.

A forest department was set up in 1856 and a strict policy of conservation and controlled exploitation of the forests has continued since that date. This department operates in the Ministry of Agriculture and Forests and is under the direction of the Chief Conservator of Forests.

The forests of Burma cover approximately 145,000 square miles or about 58 per cent of the area of the country. Of this area about 34,800 square miles or 14 per cent are in reserved forests and some 110,500 square miles or 44 per cent are in unclassed forests. These forests yield about 10 species of hardwoods known to the world market, about 40 species used in domestic trade and more than 70 species that are used locally. Among the ten export species only teak is important and of this timber, Burma has about 75 per cent of the world's supply. Bamboo, of which there are about 23 common species in Burma, is by far the most important forest product in terms of local consumption.

Forestry and wood utilization at present support about 600,000 persons or about 3 per cent of the population. In 1950, there were 158 sawmills with an annual capacity of about 557,000 round tons. The State Timber Board owned 5 of these mills and are contemplating 13 more.

B. FOREST TYPES.

1. TIMBER. The main forest types, with reference to their economic importance, are:

Mixed Deciduous:	Teak, Pyinkado	40%	Teak and most valuable hardwoods
Hill-Evergreen:	Oaks, Chestnuts, Magnoliaceae	16%	Fuel and timber for local use
Evergreen:	Dipterocarpus Pyinkado	15%	Commercial hardwoods
Dry Forests:	Cutch, Than, Dahat and Acacia	10%	Cutch and fuel tans and dyes
Deciduous Dipterocarp:		5%	Commercial hardwoods
Dry Hill:	Oaks,chestnuts, Magnoliaceae	5%	Fuel and timber for local use
Pine:		5%	Not yet developed
Beach and Dune:	Casuarina	4%	Unproductive
Swamp Forests:	Thapan	—	Unproductive
Tidal:	Mangrove	—	Firewood

2. BAMBOO. Bamboo for housing, domestic, agricultural and piscatorial purposes greatly exceeds the timber consumption because of its wider distribution, cheaper price, and handling convenience. A great variety of bamboos are available and their uses are unlimited, but the abundant resources are basically confined to domestic uses only.

3. MINOR FOREST PRODUCTS. Cutch and lac are the most important products of this type. Cutch is the product extracted from the heartwood of the cutch tree and is used to a small degree for medicinal purposes and largely for preservation of fishing nets and lines and for dyeing. Production of cutch still is a part-time industry through rather primitive methods. The average annual production in the last five prewar years amounted to about 3,500 tons.

Lac, the raw product from which shellac and button lac are manufactured, is secreted by an insect which feeds

on certain types of trees. The principal method of harvest is on a part-time basis or a side income with very little labor involved. In the past, Burma's average annual production has been approximately 1,855 tons. About 70 per cent of the total production is from the Shan States.

C. CONSUMPTION.

1. DOMESTIC USE.

a. Timber. Based on the 1939-40 timber consumption, it appears that housing and furnishings used 29 per cent, transportation and communication 14 per cent, industries 5 per cent, engineering 4 per cent, domestic and agricultural 2 per cent, others 1 per cent, and 45 per cent of the timber was exported. A breakdown of the types of wood used for each classification is included in accompanying Table I.

TABLE I

CONSUMPTION OF FORESTRY PRODUCE

(ON 1939-40 BASE)

End Use	*Teak (tons)*	*Durables (tons)*	*Semi-Dur. (tons)*	*Non-Dur. (tons)*	*Total (tons)*
1. TIMBER					
Housing and Furnishings	31,000	48,000	196,000	76,000	351,000
Engineering Construction	2,000	15,500	24,000	4,000	45,500
Transportation	16,000	77,000	52,500	23,000	168,500
Communications	100	400			500
Industry	1,500	6,500	17,500	31,500	57,000
Domestic, Agricultural, etc		3,000	6,000	9,000	18,000
Miscellaneous	1,900	3,100	7,000	2,500	14,500
Subtotal	52,500	153,500	303,000	146,000	655,000
Export	456,000	35,000	42,000	—	533,000
TOTAL	508,500	188,500	345,000	146,000	1,188,000
2. FUEL (Firewood)			*Tons (solid wood)*		
Household			6,600,000		
Transportation			150,000		
Industry			680,000		
Subtotal			7,430,000		
3. FUEL (Charcoal)					
Household			460,000		
Transportation					
Industry			47,000		
Subtotal			507,000		
TOTAL FUEL			7,937,000		
4. BAMBOOS			*Tons (volume)*		
Housing			1,694,000		
Rafting			66,000		
Domestic			360,000		
Others			5,500		
Subtotal			5,125,500		

Of the estimated 4 million houses in Burma in 1950, the housing types were of the following distribution:

50%	2,000,000 houses	Bamboo
35%	1,400,000 houses	Mixed timber and bamboo
14%	560,000 houses	All timber
1%	40,000 houses	Brick or concrete

About 300,000 tons of timber and 1,700,000 tons of bamboo are used annually for housing. Bamboo dwellings have a lifetime of from 3 to 4 years while a good timber house may last from 30 to 60 years.

Timber consumption for furniture, in Burma, like most other countries of the tropics, has been of minor importance to date. It is estimated that about 50,000 tons of timber are used annually for this purpose.

The timber used for transportation and communications includes sleepers and carriages for the railroads, material for ships and boats, for carts, and for electric, telephone and telegraph transmission and lamp posts. Ships and boats have the largest demand, using nearly 60 per cent. Table I indicates the demand on the various classes of timber.

Timber used for industries includes the requirements for the manufacture of matches and packing cases, and for mills, mines, and oil fileds. The largest use is for packing cases (44 per cent of non-durables) and next is for mining (about 35 per cent).

The use of timber in engineering construction includes bridges for railroad and highway, structures on waterways, dikes and embankments, and for harbors and wharves. Bridges have the largest demand, with nearly 85 per cent.

b. Wood Fuel. Of the estimated annual tonnage requirements of wood as fuel, firewood represents about 94 per cent and charcoal about 6 per cent. The annual consumption of wood fuel is more than 20 times the demands for housing and furnishing. In the firewood category, household use represents about 89 per cent, transportation about 2 per cent (40 per cent for rail and 60 per cent for water), and industry about 9 per cent. The annual consumption of charcoal for household use is about 91 per cent and for industry about 9 per cent. Practically no charcoal is used for transportation.

c. Bamboos. The annual consumption of bamboos is about 8 times the domestic consumption of timber. The principal uses are for domestic purposes (66 per cent), mainly for fencing, for housing (33 per cent), and for the rafting of timber (1 per cent).

d. Minor Forest Products. The domestic use of cutch is only about 5 tons annually and principally for dyes and chewing. This amount is relatively insignificant as compared to the annual production of about 3,500 tons. In the same manner, the domestic use of lac (estimated as 45 tons) is small as compared with the average annual production of about 1,855 tons.

2. EXPORT.

a. Timber. Accompanying Table II has been included to show the annual export of timber in the prewar period from 1920 to 1940 and in the postwar period to 1950. It is of interest to note the stable market condition in the 6 years prior to the war when an average of about

456,000 tons of teak was exported annually. This same condition appears in the pre-depression period of 1923 to 1930, with a high value of about 504,000 tons in the fiscal year 1925-26. Subsequent to the War, the export tonnages have been very low, no doubt due to the unsettled conditions of the country. About 10 per cent of the teak production has been used in the domestic market and about 90 per cent has been exported. Conversely, about 89 per cent of the other hardwoods are used domestically and about 11 per cent in the export trade.

TABLE II

EXPORT OF TIMBER

(*in tons round timber*)

	Teak	*Hardwood*
1920-21	454,594	87,010
1921-22	350,594	60,332
1922-23	369,170	50,216
1923-24	428,354	36,566
1925-26	504,260	54,898
1926-27	469,024	79,062
1927-28	472,674	80,366
1928-29	438,412	68,848
1929-30	448,300	79,322
1930-31	324,124	42,646
1931-32	249,678	32,356
1932-33	285,526	34,054
1933-34	315,632	45,950
1934-35	405,212	60,838
1935-36	484,148	88,726
1936-37	484,026	87,532
1937-38	457,728	86,124
1938-39	446,698	94,616
1939-40	456,321	76,384
1945-46	1,372	—
1946-47	81,152	6,196
1947-48	181,500	54,460
1948-49	133,634	40,370
1949-50	31,906	6,010

b. Minor Forest Products. The only other forest products important to the export trade are cutch and lac. Prewar, the average annual export of cutch amounted to nearly 3,500 tons and of lac about 1,855 tons. These products were both exported as raw materials with the refining being done in foreign countries.

D. POTENTIAL DEVELOPMENT.

Since forestry occupies such an important role in the economy of Burma, it is of utmost importance that full use be made of this valuable resource. It is necessary that an active program be carried out in the incorporation of forest conservation, scientific development and processing, extraction control, and in the integration of forests and industry.

As many species of trees as possible must be used to economic advantage. New forest areas should be opened. Considerations must be given to improved methods of extraction through use of mechanized equipment and in the decrease of transportation difficulties and costs. It would be advantageous to practice more improved methods of grading and conversion of more durables, semi-durables, and non-durables into a higher-use category. It further would be beneficial to improve milling and processing operations as discussed in Section VII of this report.

New building materials, such as fibreboard, chipboard, and plywood should be developed as the market demands. These new uses could increase the forest yields through use of the non-merchantable grades of timber and of sawmill wastes. Impregnation of the non-durables and semi-durables with such products as creosote and toxic salts would add greatly to their life and degree of usefulness.

The large consumption of wood fuel is a heavy drain on the forests of Burma and the possibilities of a greater utilization of such types as the dense mangrove forests of the delta area, by conversion to charcoal briquets, should be investigated.

Trees from which cutch is made make up about 10 per cent of the forests of the country. Present cutch extraction methods are rather primitive and it appears that production could be increased materially with but little improvement. This industry is also adaptable to cottage or home plan development.

One of the major considerations in forest use is the more economic utilization of the large resources in bamboo. Very good prospects appear in its use in the manufacture of pulp and paper. Further consideration is given this potentiality in Section VII of this report.

E. CONCLUSIONS.

While it is considered not within the purview of this report to recommend any changes in forest administration, conservation, and extraction as reported by the United Nations Food and Agriculture Organization report, it is desired to support their recommendations in the full development and utilization of this valuable resource. In addition, it is recommended that the transportation agencies—waterways, railways, and highways—consider the needs of forest development in the basic planning of their systems.

Section VI

THE MINERAL INDUSTRY

INTRODUCTION

The Section on Mineral Industry of Burma presented herein is further evidence that Burma contains some of the world's most highly mineralized areas and can become a principal supplier of non-ferrous metals and other mineral products. Burma is indeed fortunate in this respect. The orderly development of its mineral resources can provide in a relatively short period of time the wealth needed to establish industries and create in Burma the improved living standard desired by all its people. By utilizing its mineral wealth, Burma's progress need only be limited by the vigor and skill applied in the execution of a mineral development program.

There is no intent to present at this time a program in its entirety. Rather, this report encompasses a review of important developments that have taken place to date, discusses these as they relate to future expansion and, based upon a brief statement of the economic geology of Burma and known ore occurrences, reaches certain conclusions regarding the line along which development of the country's mineral resources should proceed. Recommendations are presented for the inauguration of a Mineral Resource Development Program and immediate action is urged in certain instances.

In broad terms the over-all program may be stated as follows:

First: Create conditions under which the existing mineral industry will produce effectively.

The value of non-ferrous metals and ores exported from Burma since 1939 are stated as follows:

Fiscal Year	*Rupees*
1939-40	6,21,75,841
1940-41	5,42,01,134
1945-46	19,48,377
1946-47	1,46,67,390
1947-48	2,19,88,138
Calendar Year	
1949	1,51,07,470
1950	1,26,30,457

Metal prices have increased greatly since 1940. A return to normal conditions in Burma should permit the present mines to produce products valued at today's prices between Rs. 8,00,00,000 and Rs. 10,00,00,000 annually. The world's markets for non-ferrous metals are strong and will take all of Burma's production without affecting price. This condition will not always exist; the importance of prompt action cannot be over-emphasized.

The petroleum industry's objective is to return to 50% of prewar production. The achievement of this production would provide Rs. 7,00,00,000 of petroleum products for export. Every assistance should be rendered to the industry to achieve its goal.

Second: World conditions foreseen in the immediate future will not in our opinion be such that foreign private enterprise will be inclined to venture its capital to develop Burma's resources. Expansion of mineral production can be obtained largely by encouraging the citizens of Burma to create new mineral development to the extent of their financial and technical capacity.

Third: The existing large mining and oil companies should be best equipped to create new large development of the nature of their present operations. They should be encouraged to devote part of their profits to expansion in their own or allied fields.

Fourth: Additional development of the mineral resources that cannot be started by means mentioned heretofore must be carried out as a Government enterprise with its ultimate disposition left to the future. The Union of Burma Mineral Development Corporation suggested is the proper agency to handle such developments with the aid of foreign consultants until the necessary technical skills are acquired by Burma's citizens.

The history of large mining operations in Burma indicates that generally the indigenous people are not dis-

posed to become miners, and mining concerns have been forced to import labor. Unless the basic reasons for this indisposition can be ascertained and corrected, large benefits from mine development will pass again to non-indigenous labor.

Colonial systems deliberately or otherwise did not transmit to the indigenous peoples the higher administrative, executive and technical skills. Often they also failed to develop the sergeants and corporals of industry, whose performance determines the efficiency of industry.

Today Burma together with other countries suffers in this respect. A major phase of any mineral resource project in Burma must be the training of Burmese citizens to independently man and carry on the project. To accomplish this in a reasonable length of time requires programs for each project specifically designed and administered by an experienced organization.

At this time definite recommendations are presented for the earliest undertaking of an antimony project. The situation in China presents Burma with an opportunity to establish itself in the world antimony market. Such opportunities do not last forever. No time should be wasted in carrying out the project. The export of the contemplated annual production of antimony metal at present prices will produce foreign exchange equivalent to about Rs. 1,10,00,000. The total capital cost of this project will be about Rs. 60,00,000. Additional money will be required for operating capital and foreign technical service.

An expenditure of Rs. 15,85,000 for exploration and research on the Kalewa Coal Project is recommended. The indications are that Kalewa coal can be produced and adapted to Burma's needs, and could become the basis for extensive industrial development in the Myingyan-Mandalay area. The possibilities indicated are a zinc plant and lead smelter, manufacture of fertilizer, a paper industry and consumer goods industries. Such a project would be a major feature in Burma's economy.

The equipment necessary to drill the Kalewa Coal Field should be ordered promptly and the work go forward as planned.

Due to limited travel permitted about the country, field work has, necessarily, been restricted. Partly for this reason no specific mineral deposits can be recommended for intensive development or expansion. It is believed that further exploration may prove up a large zinc deposit (Lough Keng) southeast of Taunggyi. The Mawson area northwest of Taunggyi offers promise of substantial lead production. The Mong Nawng area, 100 miles northeast of Taunggyi, may become a substantial producer of antimony. The same may be said regarding the Lebyin area west of Kalaw. It is reasonable to assume that the tin-tungsten placer operations in the Mergui-Tavoy area could be expanded substantially.

Further exploration and study on these promising projects will be continued as security conditions permit.

A. GENERAL GEOLOGY OF BURMA.

1. INTRODUCTION. It is appreciated that the basis for the successful exploration and exploitation of the mineral wealth of a country is a thorough understanding of the geology and the geological principles involved. This report, however, is economic rather than scientific and emphasis is given to the former. A good insight into the scientific facts can be gained by reference to the book by H. L. Chhibber on "The Geology of Burma", published in 1934. Geologic facts are static while economic developments are continually subject to changing factors. It is for the geologist and the engineer to win what nature has bestowed. It is the economic aspects of mineral occurrences that demand major attention and effort today. Hence the brief discussion that follows:

2. PHYSIOGRAPHIC PROVINCES. Burma is divided into four main physiographic units all of which extend in a north-south direction. This orientation is controlled by the geologic structure of the rocks. The four divisions are:

a. The Shan Plateau on the east and the southern extension into the Tenasserim mountain ranges. To the north it extends as a maze of hills, 30-35 miles in width along the Chinese border, that still farther north merges into the rugged mountain peaks at the northern point of Burma on the Tibetan boundary.

b. The Central Basin which roughly covers the basins of the lower Irrawaddy and Chindwin, and the Sittang River Basin. Included in the Central Basin, and on its east side, is the Pegu Yoma, a range of hills extending from Rangoon and Pegu, on the south, to the vicinity of Myingyan on the north.

Where the Pegu Yoma ends the Northern Hills begin. The Sagaing Hills pick up on the north side of the Irrawaddy and extend to the Katha District. Parallel, and to the west, is the Mingin Range and on echelon to the west is the Zibyu Tawngdan. Both of these ranges disappear south of the Hukawng Valley. To the east of this valley, the Kumon Bum extends northward to merge into the Himalaya massif of India and Tibet.

c. The Arakan Yoma on the west, and northern extension including the Chin, Naga and Manipur Hills, and farther north the Lushai and Patkai Hills.

d. The Arakan Coastal Strip. Burma is faced on the west and north by mountain walls; on the east by a high plateau of mountain proportion and on the southeast by mountains. On the south side, it is open to the sea. Burma, therefore, is a U-shaped basin with steep west and north sides and a more gentle side on the east; the mouth on the south.

3. STRATIGRAPHIC GEOLOGY. The geologic history of Burma extends from the earliest eon to what is known as Recent. All major systems of rocks are represented, but not in all parts of Burma.

The oldest rocks are found in eastern Burma, some in Tenasserim and also in the Northern Shan States. In successive periods, sediments were deposited in the sea that covered this area up to near the end of the Cretaceous period, at which time eastern Burma was elevated, and has remained dry land ever since. It has, therefore, been an area subject to denudation for a long period of time.

At one or more periods, granite magmas intruded into this thick series of sediments. Following tectonic lines of weakness, the granite has caused and, where exposed by erosion, is a part of the mountain ranges extending from southern Tenasserim northward to Upper Burma. The time of major magmatic intrusions was probably just preceding and during the Upper Eocene of Tertiary age.

The granite is the controlling economic factor in the deposition of many of the mineral deposits in eastern Burma. The more valuable are the tin and tungsten deposits, antimony deposits and the lead and zinc deposits. Other minerals also derive directly or indirectly from the same source.

Western Burma, including the Central Basin, that is all Burma west of the Shan scarp, was probably under water until about, or a little later than, the time the Shan area rose from the sea. Nothing older than Triassic sediments are exposed in the Arakan Yoma, and no sediments earlier than Eocene are found in the central mountain ranges. Here the sediments have been intruded by basic and ultra-basic rock magmas and certain ore deposits may be found in this association. The Arakan Coast is the eastern side of the Assam Basin and the area has outcrops of Tertiary sediments.

The Central Burma Basin, east of the Arakan Yoma central ranges, contains sediments from early Tertiary, Eocene age, to Recent alluvium. It is a large graben valley that has been sinking since early Tertiary time and has, thus, received the greatest thickness of sedimentary deposits near the central axis of the basin. Probably as much as 40,000 feet or more of sediments were deposited in its deepest part.

The sea that covered the basin was shallow and there was relatively continuous shifting of the ocean bed. Irregular sedimentation resulted, as shown by surface exposures and drill holes. Marine sediments coming from the south interfinger with continental sediments washed in from the land mass to the north.

This type of deposition has greatly affected the positions of the oil fields that now dot the basin. The marine sediments have been the source of generation of the petroleum. The accumulation of the oil has been controlled by the type of rock reservoir in which the oil could collect and the formation of suitable traps by earth movements such as folds and faults. Probably the largest untested area in the basin is in the marine sediments that lie south of the presently known oil fields and where surface manifestations of structure are hidden by recent alluvial accumulations.

During the Eocene, shallow-water conditions along the western shore line of the sea were conducive to the accumulation of growing vegetable matter which was later buried by fine silt and sand sendiments. These vegetal deposits were subsequently changed to coal. The coal now extends in an unbroken line for many miles along the west side of the Central Basin. It is typically exposed near the Chindwin River at Kalewa.

Economically, the Tertiary rocks are of great importance in Burma as they are the source and the reservoirs of the petroleum. The Eocene coal may also prove of great value.

4. TECTONIC LINES. The major structural features of Burma were produced by earth forces that were exerted from the east and the west. These forces were just the opposite from the Himalaya mountain-building forces that were exerted from the north and south. In Burma all major lines of tectonic disturbance have a general north-south trend. These tectonic lines are of great economic importance. The intrusive magmas follow such lines of weakness in the earth's crust and govern and localize the metallic ore deposits that are found in association with or closely connected with the intrusives.

In eastern Burma, the granites follow a trend from southern Tenasserim northward through the Northern Shan States. Wherever they are found some mineralization occurs and practically all ore deposits can trace their origin to closely associated intrusions of granite. The Bawdwin ore deposits of the Northern Shan States, the mineral province in the Southern Shan States centering around Taunggyi, the Mawchi deposits in the Kayah (Karenni) State, and the trend of tin-tungsten deposits in Tenasserim illustrate this association.

The ultra-basic intrusions that extend from the southern Arakan Yoma northward follow a major tectonic line, as do similar types of intrusions in the central Kachin State. There the metallic and non-metallic ore deposits usually occurring in such rock association may be found. Jade and other minor minerals have already been found.

The petroleum structures in the central Irrawaddy basin are found on the up-folded axes of the synclinorium. Definite tectonic lines lie to the east and to the west of this synclinal basin.

Chhibber in his "Geology of Burma", page 287, has indicated the five tectonic lines that have had a marked

effect on the distribution of mineral deposits in Burma (see map under Economic Geology 2, "Lead").

5. MINERAL PROVINCES. The close relation between the mineral areas and tectonic lines of disturbance has been discussed under the preceding title with emphasis on the magmatic intrusions which follow these weakened zones.

The granite intrusions in eastern Burma from southern Tenasserim northward have produced a definite mineral province. The most valuable minerals so far found and produced are lead, zinc and associated metals at the Bawdwin mine, and the lead in the Mawson area. In various stages of exploration and development are the zinc deposits southeast of Taunggyi and the antimony deposits occurring sporadically in many places in the Shan States and south into Tenasserim. The tin and tungsten of the Shan scarp areas, and those found to the south through Mawchi and into the mountains of Tenasserim, are in this granite-controlled mineral province.

The basic intrusions in west Burma may be considered the basis for an elongated mineral province extending from southern Arakan northward. This province is largely unexplored and may prove to contain valuable mineral deposits.

Another group of basic intrusions occurs in North Burma. These may localize mineral accumulations and produce a definite mineral province. For many years jade has been mined in one of these areas.

The Eocene coal on the west side of the Central Basin constitutes a narrow, elongate mineral province.

The whole trough of the Central Basin in which petroleum is found constitutes a mineral province that extends from Indaw on the north to Thayetmyo on the south. The province may be more extensive than present developments show. There are probably buried oil structures well to the south of the presently known fields.

B. ECONOMIC GEOLOGY.

1. INTRODUCTION. This Chapter briefly summarizes the minerals of Burma. Under Metallic and Non-Metallic minerals, only those are discussed that are now important or may at some future time become important in the economy of Burma. Known antimony and the better known tin and tungsten occurrences are listed because of their importance as a source of export minerals. Lead and Zinc are also export minerals and their respective locations are shown and potentialities discussed.

In the treatment of the minerals, where lists of occurrences have been given elsewhere, reference is made to the source. The references are in general to "Mineral Deposits of Burma" by E. L. G. Clegg, Geological Survey of India, 1944; and "Report to the National Planning Board, Rangoon", by Behre Dolbear & Company, 1949. Repetition in the current report has been avoided, as far as possible.

In the part on Coal, a list of all known occurrences is given as an aid in the search for a suitable deposit of coal with coking qualities. Otherwise, commercial-grade coal for all domestic and industrial uses will probably be supplied from the Kalewa field, fully described under the "Kalewa Coal Project".

A preliminary study of the oil fields was not assigned to the Consultants. Time has permitted only a casual examination of the present limited field operations and of the new refinery now being built at Chauk. It is hoped that at a future time there will be an opportunity to survey the operations of the industry, to review the known reserves and to assess the potentialities of the undeveloped and unexplored areas in the Central Basin. Such an evaluation of the potentials should be highly desirable now that the industry is operating as a joint venture with substantial participation by the Government of Burma.

In this report, a short description of the several oil fields and the industry in general is given together with production figures. The important geologic facts are briefly presented.

2. METALLIC MINERALS.

a. Antimony. Antimony may prove to be one of the valuable export minerals and metals of Burma. As shown on the accompanying map, deposits extend from the Amherst District, Tenasserim, northward into the Northern Shan States. There is a concentration of deposits in Amherst-Thaton Districts and at least three areas are considered very favorable. A second group is in the Loikaw area; a third, and important concentration, is in the Taunggyi area, and includes Lebyin mine on the west and Mong Sang mine on the northeast.

The occurrences and deposits are probably all associated with acid igneous intrusions although the concentrations may be in sedimentary and metamorphic rocks. A look at the attached map will show how closely the antimony mineralization follows the tectonic line along which the granite is found. In view of this and because granite intrusions are present, it might be expected that antimony occurrences may be found south of the Amherst District, Tenasserim.

A recent history of production and a list of occurrences known at this time is given. These are shown on the accompanying map.

Under E, "Antimony Project", the economics of producing antimony metal in Burma is outlined, and the foreign exchange returns estimated. The Government must, however, sponsor the project.

The antimony resources of the country have been developed only to a small degree. The Mong Hsu district produced a thousand tons of shipping ore in 1908 but has

been almost abandoned since. The Thabyu Mine was active before the war, and a large stock of ore remains at the mine. Since the war there has been some activity both in the Moulmein area and the Southern Shan States. Shipments of ore of 40 to 50% grade in recent years have been:

1946	0
1947	65 tons
1948	65 tons
1949	101 tons
1950	8 tons

There follows data on the better-known antimony mines and prospects.

(1) Amherst District

Thabyu, or Beed Mine—Map Location 1:—(officially known as Telechaung Mine) 15°12′; 98°26′. Information: Heron, 1921, 1927; Clegg, 1944; Dr. S. J. Jana, Mine Manager, Moulmein, October 1951. Large veins reported but not worked. Source of ore is loose boulders in clay matrix along outcrops. Open pits. Ore is cobbed and sorted by hand to obtain a plus 50% shipping grade. Worked on fairly large scale before the war, inactive since. 4,000 tons of shipping ore reported on hand in 1947. Sold 103 tons in 1948. Dr. Jana believes a great deal of this has been stolen and moved into Siam. Quite inaccessible. Dry season travel, one day to Kyeikdon, then 3 days by oxcart to the mine. Ore takes 5 days by oxcart to Kyeikdon, then 4 days down river to Moulmein in 5-ton boats. Takes 10 days to get back empty to Kyeikdon. Owners: Sherwood-Bailey, Ltd., Calcutta, said to be mainly the Beed family which have an antimony smelter in India. A liquating furnace was once used at the mine. Company probably would not spend money to rehabilitate mine if peace restored, says Jana.

Saw Lin Lee Mine—6 miles southeast of Beed Mine; formerly worked by Chinese, now under P/L to owners of Beed Mine. Similar to Beed Mine, working pits and loose boulders.

Lahmpa Mine—6 miles northwest of Beed Mine. Owned by U Maung Nge (ex-senator) Moulmein. Alluvial workings along tributary of Lahmpa River. Has mined 200 tons since the war, 1,000 tons previously. Tribute system. Dr. Jana says a considerable quantity of 20 to 25% "sortings" is stacked around the Beed Mine, but would not estimate the quantity.

Remoteness of these mines is a serious handicap. A truck road for transport to Kyeikdon would be about 40 miles long down a flat valley.

Paungsein Mine—Map Location 2:—15°59′; 97°46′. Information: U Sein Han, Owner; R. B. Fernandez, Thaton. Fernandez: 3′ vein, vertical, worked to 6′ depth over 200′. 30 year history. Very accessible, less than 3 miles off highway, 15 miles southeast of Amherst. Padaungchaung River has to be forded; difficult in rainy season.

Telegaun, Natsan, Letkat Taung Prospects—Map Location 3:—Telegaun 16°26′; 97°41′. 5 miles southeast of Moulmein. Examined by St. Clair, Bennett, October 1951. Two old pits, opened 30 years ago, on barely visible fractures S 30° E, in decomposed schist. Traces of stibnite. Owner, U Mya, Rangoon. Agent, Gafoors, Moulmein.

Natsan 16°23′; 97°41′. Same owner as above. Two pits 1,000 feet apart. No. 1 Pit shows 1½-foot vein with 1″ band of stibnite; quartz or quartzite walls. Strike S. 60° E. Pit No. 2 is 30 to 40 feet long, on fracture Zone 6 to 8 feet wide. Vein not visible, but fragments of stibnite stacked beside pit. Between these two pits, fragments of basic intrusive rock were found in a ravine. A smelter has been built ¾ mile from the prospects, at Natsan village, not yet completed, badly designed as an oxidizing roaster. It is said U Mya spent Rs. 30,000 in this. Small pile (½ ton) of silicous ore near smelter. Neither the Telegaun nor the Natsan prospects show much promise.

Letkat Taung 16°12′; 97°49′. Information: Imperial Institute, India; "Antimony Ores". "1885, quarry being opened, isolated pockets, few tons ore, found in or beside dikes traversing yellow sandstone of the Amherst Range".

Mihpaya Mine—Map Location 4: 12 miles south of Kwakareik 16°23′; 98°15′. Information: U On Pe, Moulmein (brother-in-law of owner). Old mine, has inclined shaft on vein, does not know how deep. Produced 100 tons before war, inactive since. Accessible, near navigable Haungtharaw River.

(2) Thaton District

Kadaik Mines—Map Location 6: 16°46′; 97°25′. Information: U On Pe, Moulmein; R. B. Fernandez, Thaton. Low grade ore over 6-mile strike, extending over ridge from near Kadaik to near Nanambin. Has been worked extensively before war, and said to have yielded a fortune to a Chinese who built the Ching Tsong Palace in Rangoon.

(3) Salween District

Panheik Mines—Map Location 7: 18°10′; 97°30′. Information: Clegg 1944 "ores reported".

Kamamaung Mines—Map Location 8: (Clegg's Wekawkye) 17°22′; 97°30′. Information: U On Pe, Moulmein. One day cart journey west of Kamamaung on the Salween River, on Tageleuma Creek. Total produced to date, 120 tons; all oxide. Recently shipped 20 tons oxide, 64% Sb.

(4) Kayah (Karenni)

Ping Chit Mine—Map Location 10: 19°56′; 97°09′. Examined by St. Clair, Ba Thi, Bennett, October 28, 1951. Abundant stibnite float in narrow creek channel

over 1,000 feet. No vein or other solid formation visible. Limestone country rock. Boulders show stibnite replacing limestone. Twenty-foot tunnel, driven some years ago, did not reach solid rock. Estimate 20 tons or more, shipping grade, may be recovered in creek. Recommended clear road to site, geological study to determine tunnel site. (Letter to Sao Wunna, Minister of Kayah (Karenni) State). Ten miles off highway running north of Loikaw.

Ngwedaung Mine—Map Location 11: 19°32′; 97°17′. Information: Sao Wunna, Minister of Kayah (Karenni) State. Old working, idle since 1941.

Hwe Pitpe—Map Location 12: 19°09′; 97°41′. Information: Sao Wunna. Known ore occurrence. On both sides of Wan-hwe-aw River.

(5) Southern Shan States

Lebyin (Pindaya Thein) Mine—Map Location 15: 20°39′; 96°26′. Examined by St. Clair, Ba Thi, Bennett, November 1, 1951. Two mines. Only one visited. Several active pits along N.S. strike, between railway and river, 1 mile South of Lebyin. Fracture zone in sandstone, well silicified on each side of zone. Fracture zone 6′ to 8′ wide, with irregular veinlets and bunches of stibnite. Pits up to 10 feet deep. Upper 4 feet oxidized, unaltered from there down. Specimens of oxide found, but ore is mainly stibnite in hard quartzite. Hearsay: "15 pits (6 active) along 1½ mile strike in this group, and 35 pits (2 active) in the other group which is three miles away. The second group is similar to the first in ore occurrence." Thirty men working at time of examination, probably 120 in dry season. Tribute system. Yield of ore calculated from one pit, 2 to 3½% Sb. Shipments of 15 tons ore made, and sold at Rs. 800 f.o.b. Lebyin. Shipping ore looks like at least 50% grade. Only one property, belongs to Daw Saw Khin, widow of former owner. Operated by three men including the headman at Lebyin, paying one-third of gross return to the owner as royalty.

Menetaung—Map Location 16: 20°59′; 96°34′. Information: Clegg, 1944. "North-south vein in argillaceous limestone".

Ho Pong (Meckemegun) Mine—Map Location 17: 20°43′; 97°16′. Examined by Min Din, October 16, 1951. 2 to 3 miles southeast of Ho Pong Manganese mine. Fracture in hard blue limestone, NIZE. Small pit, 3′ x 3′. Stibnite occurs in pockets. "Not impressive." Near village of Meckemegon. Property of Sao Khun Law, Sawbwa and Assistant Resident of Ho Pong. Some ore has been shipped.

Pan Koi (Mong Pawn) Mine—Map Location 18: 20°40′; 97°28′. Examined by Min Din October 14, 1951. ½ mile east of Pan Koi village. Worked by Chinese; pit 10′ deep, 20′ long. Vein in limestone, pinches out at edge of pit. Worked by Japanese who in '43-'45 drove several tunnels.

San Phu Mine—Map Location 19: 20°52′; 97°30′. Hearsay by Min Din, October 1951. 5 miles northeast of Mong Pawn. Said to be larger than Pan Koi.

Hpawnhsing Mine—Map Location 20: 21°07′; 97°19′. Information: R. M. Aldworth, Taunggyi. "Mine recently opened."

Mong Hsu (Naking) Mine—Map Location 21: 21°54′; 98°23′. Information: Jones, 1917; Clegg, 1944. Imperial Institute "Antimony". "Ore showings along north-south strike through a hill. Samples: 3½-ton shipment, 35% Sb; liquated sulphide, 70% Sb; 3½- and 4-ton shipments, 33%, 42%." Clegg: "Mong Hsu State produced 1,000 tons in 1908. Old workings south of Menetaung village. North-south vein in argillaceous limestone. Worked on small scale for some years." Imp. Ins.: "Location, just north of Nahok or Naking on Nam Pang River. Thick clay covers most of deposit; purple sandy shale and limestone with low-grade antimony."

Mong Sang Mine—98°25′; 21°41′ producing 150 tons per month currently, 60% grade. Transport by mule and ox-cart to Wan Hpakha, across Nam Pang River, thence by truck to Taunggyi. Also working is Nan Hok Mine, near Wan Hpakha 98°17′; 21°47′ producing 100 tons per month. Information: S. K. Moorthy, Manager Mong Nawng Mining Corp., November 30, 1951.

Mong Ing—Map Location 22: (Kem Tung State) 21°07′; 99°19′. Information: Clegg: '44. "Small and low grade."

Mong Pan—Map Location 23: 20°20′;98°22′. Information: R. M. Aldworth, Taunggyi. "Favorable prospect."

(6) Northern Shan States

Hsum Hsai—Map Location 28: 22°28′; 96°34′. Information: Clegg, '44. "Known occurrence."

b. Beryl.

No primary deposits of beryl have been found in Burma. Small amounts are found in the alluvium at Mawchi Mine. These are probably derived from the pegmatites that occur in the ore zone in the granite.

It is reported that beryl is an important component of the wolframite found in the area centering at about 20°00′; 96°20′, some 35 miles southeast of Yamethin. In the early mining the beryl was discarded; plans are now under way to recover it. The deposits in the area are probably lode and eluvial with some as alluvial.

c. Chromite

There are recorded four occurrences of chromite that are located on the eastern slope or foothills of the Arakan Yoma, Southwest Burma, and five that are located in the Kamaing sub-division of the Myitkyina District, in the vicinity of 25°45′; 96°21′. All of the occurrences are associated with the same type of basic rock.

Prospecting for chromite should be confined to the areas where basic igneous rock occur. In the same association, iron ores, nickel, copper, magnesite, talc and asbestos may be found.

The ultra-basic rocks in Burma are found chiefly in a northward curving arc from southern Bassein to upper Burma. Again they are found in the ridges in the upper part of the Central Basin in the Myitkyina District.

d. Cobalt.

No deposits of cobalt have yet been found in Burma. However, cobalt is an associated mineral in the complex ores of the Bawdwin Mine, Northern Shan States, about 50 miles northwest of Lashio.

In the smelting of the lead concentrates, the cobalt is collected in the speiss, the cobalt content being about 6.60 per cent. The other metals in the speiss are nickel 31.20%, copper 9.39%, and silver 15.70 ozs. per ton.

In 1938, over 200 tons of cobalt were recovered from the Bawdwin ores. This amount made Burma the world's fifth largest producer. Cobalt at this time is an important strategic mineral in scare supply. An amount such as was produced in Burma in prewar days is an appreciable addition to the supply. Only limited shipments of cobalt-bearing speiss have been made from Burma since early 1942.

e. Copper.

There are a number of minor occurrences of copper in Burma but none have any economic value except at the Bawdwin Mine where it is a constitutent of a very complex ore. A complete list of places where even a semblance of copper minerals has been found is given by Clegg in his report (cited in the introductory remarks).

All copper produced in Burma in past years has come from the Bawdwin Mine. Small amounts are found in association with the lead-zinc mineralization but the lower part of the Meingtha vein is mostly chalcopyrite, the iron-copper sulphide. The Chin lode is also copper, lead and zinc being in very small amounts.

A prewar estimate indicated that as of July, 1939, Bawdwin ore reserves contained approximately 280,000 tons of copper ore in a total ore reserve of 3,600,000 tons. Production at that time included 9,000 tons of copper matte, the copper content of which was 42 per cent. Of 3,600 tons of nickel speiss, the copper content was 8 per cent. In 1940, the estimated metallic copper content of the reserves was 17,123 long tons, or more than 38,000,000 lbs.

When steady production of ore is again attained at Bawdwin, it will be at only 20 per cent of the former amount. This will be stepped up to a possible 50 per cent as soon as practicable.

The copper matte and nickel speiss are shipped to England for refining as well as antimonial lead containing 23.10 per cent antimony.

f. Gold

Burma has been an unimportant producer of gold and at present no real mining operations are being conducted. Gold-bearing alluvials are washed in various areas, many of which are in Upper Burma. A long list of placer workings is given by Clegg and need not be summarized here.

Reports are that gold can be found in most rivers and streams in Burma, but this only means that there are gold-bearing rocks in Burma, not necessarily commercial-size deposits, lode or placer. However, prospecting should be encouraged but confined to the favorable rock areas or within their watersheds.

g. Iron.

There are some 21 iron-ore deposits in Burma that have been reported in more or less detail. They may be divided into two general classes: Residual Chemical Concentrations and Magmatic Segregations. The first category may be either of two types of accumulation: Limonitic and Hematitic, and Lateritic.

Under the magmatic segregation class only three deposits are known; others may be found. In Burma this group as known today is unimportant.

Under the residual ores group, the laterite iron deposits have received little attention from a mining standpoint. The more important deposits are those of limonite and hematite, the latter especially.

The only consistent iron mining in Burma has been done by the Burma Corporation, Limited. Their operations have provided iron-ore flux for the smelting of the ores of lead and associated minerals derived from the Bawdwin Mine.

Production of iron ore in Burma averaged close to 25,000 tons per year for the interval from 1934 through 1940. Practically all of this was for use at the Namtu smelter of the Burma Corporation, Limited.

A few of the iron ore occurrences are given by Clegg and by Behre, and a rather complete list may be found in the report by the "Economic Commission for Asia and the Far East, Sub-Committee on Iron and Steel", 10 April, 1950. The best discourse on the "Iron Ore Deposits of Burma" is by Pitt W. Hyde, Mining Consultant, Rangoon, 29 September, 1951.

Although no iron-ore deposits of any size have yet been found in Burma, exploration should continue in conjunction with field examinations of mineral districts. The Namtu smelter must be provided with sufficient iron ore for fluxing purposes. Furthermore, if a small steel industry, based on scrap steel, should be established in Burma, a supply of iron ore would be almost

essential for the manufacture of pig iron required for mixing with the scrap in furnace charges.

Probably further consideration should be given to the group of mineral deposits northeast of Mandalay which includes Twinnge, Pauktaw, Naungthakaw and Bawhlaing; and the deposits southwest of Lashio which include Manmaklang and Man Pat (Nam Phat).

Near the town of Tavoy there may be a deposit of iron of such size as to encourage development. The grade is about 60 per cent. It should be carefully surveyed. From descriptions given there may be three to four million tons in sight.

Iron ore is reported to occur in quantity on Loilong some 30 miles southeast of Loikaw and 12 miles northeast of Bawlake, Kayah (Karenni) State, and lying between Nam Pawn and Salween Rivers. There are no published facts on this occurrence. It is recommended that the Loilong area be surveyed as soon as security is established.

h. Lead.

Bawdwin Mine is Burma's largest producer of lead and ranks as one of the great lead-silver mines of the world. The lead is found associated with zinc, copper, silver, cobalt, nickel and antimony.

The lead sulphide is separated from the zinc sulphide. The major part of the other minerals remains with the lead concentrates which are smelted at Namtu. The products from this operation are lead metal and refined silver; copper matte which contains also some lead and silver; nickel speiss which contains also some copper, cobalt and silver; and antimonial lead which contains chiefly lead, lesser amounts of antimony, and some silver.

The refined lead is the principal metal exported from Burma. (Tin and tungsten and zinc are shipped as concentrates.)

The geology and mineral occurrence of Bawdwin are presented elsewhere. It may be said here, however, that so far no other similar lead occurrences have been found in Burma. Other lead deposits have a different geologic setting.

Recommendations are being made for a thorough study of two mineral quadrangles in the Southern Shan States that center around the Mawson area and Taunggyi and Kalaw (approximately 20°30′ to 21°00′; 96°30′ to 97°30′). These quadrangles, and adjoining areas, contain important deposits of lead found both as the carbonate, in the weathered zone, and as the sulphide at depth. Mawson may be said to center the area of greatest present activity. Shipments are being made regularly. More details are given under "Areal Development Projects—Southern Shan States." (See map.)

In this region the lead deposits are predominantly associated with limestones and occur in distinct fissures or veins in the hard limestone or in the weathered surface zone. (The latter is typical in the mining area just south of Mawson.)

The lead deposits of Burma are definitely oriented along tectonic lines. One such line of disturbance passes through the quadrangles mentioned, Mawson-Taunggyi district. The same line passes through the Bawdwin mine area, Northern Shan States. Farther to the north, near the Chinese border, three other deposits are known and the presence of slag indicates that they were worked in early days by the Chinese, presumably for their silver content.

The general Mawson region has another tectonic line passing just to the west with several occurrences of lead and zinc, and one of antimony lying between the two lines.

In most of the occurrences studied, acid-rock intrusions are found. There appears to be genetic relation between all of the primary lead ore deposits and this type of igneous rock. This is not to say that some deposits may not exhibit definite secondary characteristics, but primarily the deposits have generated from aqueous solutions that have emanated from the acidic magmas. Other minerals associated with the lead, and also the separate antimony deposits found in the same general area, had a similar if not the same source magma.

A goodly list of lead deposits scattered throughout eastern Burma are given by Clegg and by Behre. The recent "Review of the Lead-Silver-Zinc Depoits of Burma" by Pitt W. Hyde, Mining Consultant, concisely summarizes the lead occurrences and emphasizes those of reasonable promise. (See accompanying map.)

i. Manganese.

The Japanese, during their occupation, opened a manganese deposit five miles south of Ho Pong, location 20°44′; 97°15′. Some 3,000 tons were mined and stored on the property. It was later sold and transported to railhead at Shwenyaung, west of Taunggyi, but has not yet been shipped.

Of a total width of 99 feet, 51 feet of manganese ore is exposed for 200 feet. Analysis of a sample from the richer portion of the deposit shows 56.11% Mn., 1.20% Fe., and 1.84% insoluble. The upper four feet and at the sides the ore deposit is a soft manganiferous earth. The wall rock is limestone.

The value of the Ho Pong manganese deposit can be determined only through a careful survey. The showing warrants further investigation.

Several minor occurrences of manganese associated with residual iron ore are reported in the Central Basin.

Two other occurrences probably merit an early examination. One is the ore in the low hills near Yaynay and Sein Kyaung along the Sittang River; the second is on certain islands in the Mergui Archipelago where se-

lected ore specimens run as high as 53 per cent manganese with a low iron content.

j. Molybdenum.

There are no known deposits of Molybdenum in Burma. Some is recovered as a by-product in the mining and milling of tin and wolfram ores.

Tin and wolfram are intimately related with the granite intrusions. Molybdenum might be found in veins or pegmatites and in the altered parts of the granite.

In a metallic mineral province such as extends northward from Tenasserim, prospecting may be confined largely to the contact zones and in or close to the peripheral areas of the acid granite intrusives.

k. Monazite.

Monazite sands are reported in a few areas in Burma. The sands are probably too lean to be of commercial value. However, in dredging or other alluvial mining operations for tin and tungsten, monazite sands might in some instances be recovered as a by-product at very small additional cost.

The tin and tungsten areas in Tenasserim are favorable locations, and rich sands but very small in quantity are found in Mong Kung, a Southern Shan State, village of Wan Hapalam (21°32′; 97°28′).

l. Nickel.

Burma's only source of nickel is the speiss produced from the Bawdwin mine ore at Namtu smelter. The speiss contains 31 per cent of nickel along with copper, cobalt and silver. It is shipped abroad for treatment and recovery of its metal content.

Any individual deposits of nickel found in Burma will probably be associated with basic igneous rocks such as are found in the Arakan Yoma and in places in North Burma. These areas might profitably be explored because chromite, copper, iron, asbestos, magnesite, talc and other minerals occur in association with similar rocks.

m. Silver.

Silver is recovered in Burma only as a by-product in the mining of ores of other metals, chiefly those of lead and zinc. The Bawdwin ores are the principal source of silver, the recovery in prewar times being upward of 60,000,000 ozs. per year.

In addition, the copper matte contains over 65 ozs. silver per ton, the nickel speiss about 16 ozs. per ton, and the antimonial lead nearly 3 ozs. per ton. This silver is recovered at reduction plants in the U. K., no such facilities being provided in Burma.

Silver is also found in the lead ores of the Mawson mining area, Southern Shan States, and in adjacent sections.

Other lead ore deposits on the Shan Plateau and those in the Kachin State, North Burma, will also probably carry silver.

n. Tin and Tungsten.

Tin and tungsten are discussed under the same heading because in many instances in Burma they occur in the same deposit. In fact, more than half of Burma's production of these metals was, prior to the war, exported in the form of mixed concentrates of cassiterite and wolframite.

The known occurrences of tin and tungsten minerals are located in a fairly narrow strip of country running for over 750 miles in a northwesterly direction from the southern tip of Burma at Victoria Point, through Mergui, Tavoy, Amherst, Thaton, Mawchi, the Yamethin and Kyaukse districts to Yengan; it also includes the western part of Mong Pai State. The southeasterly continuation of this strip runs through the tin producing areas of the Malay peninsula and Indonesia and within its eastern boundary are also located the tin and tungsten deposits of Thailand. The vein deposits originate from the granite magma; the detritol deposits from the weathering of the veins and subsequent concentration. The granite forms the core of the mountain ranges. The ore deposits are characteristically associated with granite bosses which are intruded into the sedimentary rocks. Erosion has exposed some of the bosses. Study of the intrusion of the granite and the subsequent mineralization from the meteoric gases and waters of this acidic magma is essential to an understanding of the origin and modes of occurrences of the tin and tungsten deposits.

The principal occurrences of economic importance so far exploited are filled fissure types of quartz veins and their eluvial and alluvial detrital products. Although in certain localities both wolframite and cassiterite occur very sparsely distributed in the granite itself, such deposits have so far been considered of little economic value. Greisen bands occurring in the granite on the walls of the quartz veins are typical in many localities. Although these bands, as well as pegmatitic dikes which are frequently found traversing the granite, often contain cassiterite and wolframite, they, also, have not generally proved economically important. However, considering presently indicated trends of world metal demand and price, it is likely that exploitation of certain low-grade occurrences in the granite may become economically justifiable even before the higher-grade deposits of these minerals become exhausted.

The accompanying reference map and tabulation show the location of most of the better-known occurrences of tin and tungsten in Burma. No attempt has been made to differentiate between them on the map. While in most localities both minerals are found, there are exceptions which merit comment, so far as deposits of proved economic value are concerned.

Where large alluvial deposits are worked, very little

and sometimes no wolframite is recovered. Unlike cassiterite, wolframite, because of its structural and physical characteristics, undergoes such rapid comminution to fine sizes during erosion and stream transportation as to generally preclude its deposition in economic amounts in alluvials at any considerable distance from its source.

Thus, in the Mergui district, the bulk of the metal production consists of tin concentrates recovered from widely scattered alluvials. There are some places where only wolframite is obtained, and others from which mixed concentrates are produced. In 1938, only 298 tons of tungsten concentrates were produced as contrasted with 1,889 tons of tin concentrates. In the Tavoy district, on the other hand, the production of tin and tungsten is largely from eluvials and veins, the most noteworthy exception being the alluvials of the Heinze basin which are dredged only for their cassiterite content.

Farther north, the alluvials mined in the Amherst district contain comparatively unimportant quantities of wolframite whereas at Thaton, still farther north, 80% of the production is wolframite. At Mawchi Mines, in Kayah (Karenni), nearly all the production of mixed concentrates is obtained in roughly equal proportions from the underground mining of quartz veins. In the Yamethinin district wolframite occurs predominantly in the veins which have been exposed.

Altogether, including the principal occurrences of tin and tungsten under reference, more than six hundred have been reported. It is noteworthy, however, that from 1936 to 1939, a period of vigorous mining activity, 88% of Burma's production was obtained from 46 mines or only 8% of 583 mines reported as operating during the period. In the fiscal year ending March 31, 1941, approximately 36% of Burma's total output was produced by one mine only, the Mawchi Mines, Ltd. The latter is the only lode mine that has conducted efficient underground and surface operations consistent with good modern practice. Because of its importance, it is discussed in more detail in a subsequent part of this report.

The 15,607 tons of concentrates reported to have been exported from Burma for the fiscal year ended March 31, 1941, the last war year for which there are comparatively reliable records, contained an estimated 5,032 long tons of fine tin and 458,500 long-ton units of tungstic oxide. Burma valued these exports at Rs. 3,06,46,619. At £910 per ton for spot tin and 485 shillings per long-ton unit of WO_3, as quoted in London at the beginning of 1952, the value of such an annual production can be estimated approximately at the equivalent of Rs. 21,10,54,256, an amount which, less realization charges, would place this section of Burma's mineral industry high in importance in the country's economy as a producer of foreign exchange.

Should conditions permit the resumption of unrestricted mining under normal conditions, annual production would probably exceed the 1939-40 average because of price stimulus. The industry's economic potential can be further emphasized through a realization of the increased production which could result from more efficient development and exploitation of many of the known vein deposits; by the construction of roads to areas known to be mineralized but where so far economic access has proved difficult or impossible; and from systematic exploration of comparatively little or completely unknown areas.

Reference to the accompanying map will show a number of occurrences of wolframite and cassiterite north and south of Mawchi. These areas, particularly east of Yamethin, are not easily accessible. Other occurrences have been reported in the vicinity of the Thai border, both northeast and east of Mawchi. However, no deposits comparable to those of Mawchi are known. Perhaps there is little likelihood that an intrusive granite boss similarly exposed by erosion could have been overlooked. Such granite bosses may well exist, however, where there is little or no surface indication. Hence, known vein deposits should be examined with this possibility in mind. In any exploration and development program, attention should be directed to exposures of granite and metamorphosed sediments in the area generally east of a line running through Mergui and Mandalay and, more specifically, in the Dwana range on the east, in the Thaton and Amherst districts.

The Tenasserim peninsula coast has sunk in recent geologic time. Low coastal areas have been submerged and now form sub-sea shallow areas, some of which extend 15 miles out from the present shore line. When compared to the island of Banka in Indonesia, there is reason to believe that alluvial tin and tungsten may be found in concentrations rich enough to dredge.

Two types of deposits can be visualized, one as concentrations in old stream channels that may extend out from the shore for considerable distances in trends more or less perpendicular to the present shore; the other, in underwater ridges that parallel the shore line, consisting of eluvial deposits that formed along mineralized veins that were broken down by subaerial weathering and which have remained largely in situ, and in which there may have been further concentration by tidal action.

Dredging by buckets can be done to a depth of 120 feet. If the water is not over 80 feet in depth the alluvium can be recovered to an additional depth of about 40 feet or more. At Banka work is being carried on in 80 feet of water and a mile or more from shore.

Some sub-sea prospecting has been done from Victoria Point north nearly to Moulmein. Values have run from

1 to 3 lbs. tin per cu. yd. Wolframite has also been found in amounts from 2 to 7 lbs. per cu. yd.

There follows data on the better-known tin and tungsten mines and prospects.

TIN AND TUNGSTEN DEPOSITS IN BURMA

Description	*Location*	*Remarks*
(1) MERGUI DISTRICT		
1. Bannuni	10°44′; 98°45′	Alluvial tin
2. Bokpyin	11°14′; 98°50′	Alluvial and eluvials derived from pegmatite veins
3. Hangapru	11°01′; 98°50′	Stockworks of stanniferous quartz veins
4. Hosamkong	11°31′; 99°12′	
5. Karathuri	10°56′; 98°48′	
6. Kazat	12°13′; 98°47′	Alluvials derived from pegmatite veins
7. Khe Chaung	11°37′; 99°02′	
8. Lenya River	11°28′; 99°02′	Numerous alluvial deposits
9. Maliwun	10°14′; 98°39′	Tin alluvials containing some wolframite; also lodes
10. Migyaung Kyaung	11°25′; 98°46′	Alluvials and pegmatites
11. Ngawun River	12°10′; 99°08′	Coarse stream tin
12. Pakchan River	10°00′; 98°35′	Tin alluvials
13. Palaw	12°55′; 98°40′	Tin alluvials
14. Palauk River	13°16′; 98°44′	Lodes and beach alluvials containing tin and tungsten
15. Sadion	11°23′; 98°48′	Abandoned workings
16. Tagu	12°16′; 99°04′	Veins carrying cassiterite and predominantly wolframite
17. Taungkanet	11°08′; 98°44′	Alluvial tin in mangrove swamps
18. Thabawleik	12°01′; 99°16′	Large alluvial deposits of tin
19. Theindaw	12°20′; 99°10′	
20. Theinkun	11°52′; 99°29′	Stream tin and pegmatites carrying wolfamite
21. Tetwe	11°04′; 98°46′	
22. Yamon	12°13′; 98°47′	Alluvials derived from pegmatite veins
23. Yengan	11°28′; 98°48′	Tungsten lode and alluvial tin
24. Kings Island		Tin alluvials
25. Kissering Island		Tin alluvials
26. Davies Island		Tin alluvials
27. Lampi Island		Tin alluvials
28. Pula Boda Island		Tin alluvials
(2) TAVOY DISTRICT		
29. Bawbin	14°09′; 98°23′	Tin and tungsten eluvials
30. Pyingyi (Heinze Chaung)	14°37′; 98°02′	Tin Mine
31. Byaukchaung	14°17′; 98°17′	Veins carrying tin and tungsten
32. Dahchaung	14°02′; 98°28′	Wolfamite in veins
33. Egani	14°21′; 98°07′	Tin and tungsten in veins, eluvials and alluvials
34. Heinda	14°06′; 98°31′	Large alluvial tin deposits
35. Heinze Basin	14°45′; 98°00′	Dredge exploited tin alluvials
36. Hermyingyi	14°15′; 98°35′	Tin and tungsten lodes
37. Hnantazauk	13°31′; 98°31′	Wolframite
38. Hpaungdaw	14°02′; 98°33′	Lodes and eluvials carrying tin and tungsten, chiefly the latter
39. Meke	13°46′; 98°28′	Tin-tungsten veins with low tin values
40. Myekanbaw	14°17′; 98°25′	Tin-tungsten alluvials and eluvials
41. Nyaung Chaung	14°32′; 98°28′	Tin in pegmatites, veins and brecciated areas
42. Pachaung	14°31′; 98°05′	Tin and tungsten veins
43. Padet Chaung	14°03′; 98°20′	Tungsten deposit
44. Pagaye	14°06′; 98°19′	Crisscrossed pegmatite veins, and eluvials carrying tin and tungsten
45. Paya	14°35′; 98°00′	Tin and tungsten
46. Pe	13°38′; 98°34′	Wolframite in quartz veins
47. Putletto	14°04′; 98°28′	Many veins with wolframite and a little cassiterite
48. Kadwe	13°35′; 98°25′	Veins containing wolframite
49. Kalonta	14°19′; 98°17′	Veins and alluvials with tin and tungsten
50. Kanbauk	14°35′; 98°03′	Veins, eluvials and alluvials with tin and tungsten
51. Kha Maung Hla	14°17′; 98°16′	Tin
52. Khat	14°08′; 98°20′	Tungsten
53. Khe Chaung	14°03′; 98°05′	Tin and tungsten
54. Kyauk Me Daung	14°10′; 98°26′	Dredging and sluicing, principally for tin
55. Seikpyan Myittha	14°10′; 98°33′	Tin
56. Talaingya	14°17′; 98°13′	Tin and tungsten
57. Taungpila	14°13′; 98°24′	Tin and tungsten lodes and alluvials
58. Thingandon	14°10′; 98°21′	Tin and tungsten alluvials
59. Thitkado	14°17′; 98°19′	Veins and eluvials carrying tin and tungsten
60. Wagon	14°11′; 98°24′	Veins, eluvials and alluvials yielding tin and tungsten
61. Widnes	14°04′; 98°28′	Wolfamite-bearing lodes
62. Yamazu	14°08′; 98°20′	Veins and eluvials with tin and tungsten
63. Zinba	14°38′; 98°12′	Veins and eluvials with wolframite

(3)	AMHERST DISTRICT		
	1. Belugyun Island	16°21′; 97°33′	Alluvial tin
	2. Sakangyi	15°51′; 97°47′	Alluvial tin
	3. Paya	15°45′; 97°57′	Alluvial tin
	4. Myettow	15°37′; 97°58′	Alluvial tin
	5. Thanbya	15°40′; 98°02′	Alluvial tin
	6. Ye	15°15′; 97°50′	Wolframite
(4)	THATON DISTRICT		
	1. Kadeik	16°46′; 97°27′	Tin alluvials
	2. Zingyaik	16°40′; 97°25′	Tin and tungsten in veins and pegmatites
(5)	SO. KAYAH (KARENNI)		
	1. Mawchi Mines	18°47′; 97°08′	Tin and tungsten-bearing quartz veins and alluvials; some stream tin.
(6)	MONG PAI STATE		
	1. Abdul Haq's Mine	19°51′; 96°46′	Wolframite
	2. Boma Ale (three mines)	19°33′; 96°26′	Those and many other occurrences of wolframite in veins and eluvials in western part of State: tin occurs less frequently.
	3. Peinnedaik	19°39′; 96°36′	
(7)	KAYAH STATE		
	1. Palamow	20°37′; 96°52′	Wolframite in quartz veins
	2. Padatgyaung	19°40′; 96°36′	Wolframite in quartz veins
	3. Kyat Pyin	19°46′; 96°33′	Wolframite in quartz veins
	4. Near Nyemataук	19°48′; 96°27′	Wolframite in quartz veins
(8)	YAMETHIN DISTRICT		
	1. Byingye	20°01′; 96°29′	Quartz veins carrying wolframite
	2. Byingye area	19°36′; 96°26′	Quartz veins carrying wolframite
	3. Hmanpya-taung	19°37′; 96°26′	Quartz veins and eluvials carrying wolframite and cassiterites.
	4. Kwedugyi	19°50′; 96°25′	Wolframite
(9)	YENGAN STATE		
	1. Nyaunggyat	21°06′; 96°13′	Quartz veins with wolframite.
	2. Thwingyaung		Tin and tungsten occurrences in veins and eluvials; some stream tin; many other prospects and small workings.
	3. Mekontaung		
	4. Moksomadaung		

o. Zinc.

The Bawdwin mine is the only source of the zinc concentrates produced and shipped from Burma. There is presently at the Namtu concentrating plant about 85,000 tons of zinc sulphide concentrates with a metal content of about 57,000 tons. Prewar, Namtu produced about 66,000 tons of zinc-sulphide concentrates annually. The present program of rehabilitation calls for a production of about one-third this amount, or some 22,000 tons per year. It is hoped that at a later time these concentrates may be reduced to zinc metal in Burma (see "Myingyan Project").

The zinc sulphide is a component of the complex ore produced at the Bawdwin mine and is associated with lead, copper, silver, and other minerals. Lead is the most prominent mineral in the deposit.

A large deposit of zinc carbonate has recently been explored at a locality about 25 miles south of Mong Pawn, Southern Shan States, and a preliminary shipment made. Probably a million tons is exposed and amenable to open-cast mining operations. The carbonate is reported to grade into sulphide ore at shallow-depth. This deposit is discussed more fully under "Areal Development Projects—South Shan States." Development of this deposit will call for a concentrating plant at the mine or near railhead. The concentrates can be smelted at Myingyan when a zinc reduction plant is built.

3. INDUSTRIAL MINERALS.

a. Amber. The only area in Burma from which an appreciable amount of amber has come is the Hukawng Valley, Myitkyina District, between Lalang and Maingkwan (26°18′; 96°32′). The amber, a fossil resin, is found in association with seams of lignite or coal over a distance of about eight miles. The sedimentary beds dip steeply and, with the primitive mining method used, no appreciable depth can be reached. A few other small and untested deposits are listed by Behre and by Clegg in their reports. More important mineral deposits should have preference of investigation over the amber occurrences.

b. Asbetsos. No deposits of asbestos of commercial size have yet been found in Burma although occurrences have been reported in the Arakan Yoma, chiefly on the eastern slopes. Probably there would be no large demand for asbestos in domestic use but there would be a ready export demand for long-fiber, high-grade asbestos. Although it has many uses, the chief ones are in the manufacture of fireproof and chemically-resistant fiber materials.

Asbestos is found chiefly in basic igneous rocks or

highly-metamorphosed schists. These are characteristic rocks in the Arakan Yoma. Field examinations should be limited to this range and to areas of comparable rock formation and structure in Upper Burma.

c. Barites. The production of barite in Burma in past years has been small although there is a constant demand for it in the domestic oil fields. The most important use of barite is in the petroleum industry, where it is used in a heavy mud solution for rotary drilling. If paint and chemical industries were established in Burma, a small amount of barite would be consumed by them. Barite can be used to advantage in the production of glass.

Probably the most important barite mineralization is found in the lead-carbonate belt that extends roughly from Mawson (20°55′; 96°47′) southward to include the present working mines and probably as far south as Kyawktap. Mawson is in the Southern Shan State of Yawngwe.

The barite is found in association with the lead ores and probably occurs as narrow veins, as does the lead. No attempt has been made to save the barite in the mining of the lead carbonate ore, and the present method of mining does not economically warrant its recovery. However, if more modern methods were adopted and a washing plant used in the beneficiation of the lead ore, at least some of the barite could be included in the mine-run ore and recovered in the washing plant. A more modern method of mining and ore dressing in this area is suggested under "Areal Development Projects—Southern Shan States." Attention should also be called to the Paupyet barite prospect about 12 miles northeast of Mawson (21°3′; 96°56′).

In the Mandalay District, near Anisakan (21°59′; 96°24′), about 20 miles east of Mandalay, 160 tons of barite was mined from one lens. The occurrence is probably very irregular, else more activity would have been shown.

A few other occurrences of barite in Burma have been noted, probably the most important of which is in the Thabyi area where it occurs in association with the antimony ores. This area is in the Amherst District, Tenasserim, and at about 15°31′; 98°31′. The section is not accessible at this time and no field examination can be made to determine the value of the antimony and barite deposits. Considerable antimony ore, however, has been shipped via Moulmein.

Some barite is found in association with the lead-silver-zinc ores of the Bawdwin Mine, Northern Shan States, but not in important amounts. There may, however, be a distinct vein of barite in the area inasmuch as it is found plentifully scattered over a wide surface.

d. Bauxite. Bauxite is the chief mineral from which aluminum, a metal, is obtained. It is discussed under nonmetals, however, because the alumina, which is converted into the pure metal, is a clay-like product and is mined and handled as such. Some clays may be so high in alumina that they can be considered an ore or source of aluminum.

The discovery of bauxite in Burma would provide another export product but not one on which a domestic industry could be founded. The capital investment in the aluminum manufacturing business is too great, highly-trained technical personnel too scarce, and access to extractive process too remote to encourage the thought of an aluminum industry in Burma. To meet the export market bauxite must be produced to tidewater at a very low cost.

There are no encouraging occurrences of bauxite or high-alumina clays known in Burma at this time.

e. Building Material and Road Metal. These materials are generally produced and used locally, except in the delta country where they must be brought from other sections.

The several types of stone used are granite and gneiss, laterite, limestone, sandstone, and trap rock. Most of these make good road metal and railroad ballast; some can be used in building construction although there are not many such requirements in Burma.

Granite and gneiss are found from lower Tenasserim north along the western edge of the Shan Plateau to the Mandalay, Katha, Bhamo and Myitkyina districts. The best laterite comes from the Thaton district. Another source is the southern extension of the Pegu Yoma on a ridge lying between the railroad lines to Prome and Pegu. Limestone is found throughout eastern Burma, on the Shan Plateau and in the Tenasserim. Sandstones occupy the Tertiary Basin area, including the Pegu Yoma. The Namyan sandstone, in the Shan Plateau country, is an excellent building stone due to its hardness. Trap or basalt rock is found in the lower Chindwin District and in the Shwebo District, and in minor quantities in other areas. Moulding sands used in the Rangoon foundries are obtained north of the city from the ridge that extends southward from the Pegu Yoma.

A white marble from the Sagyin Hills, 20 miles north of Mandalay, is used for carving images of the Buddha. The carving is largely done at Mandalay and Sagaing.

f. Cement Materials. Portland cement is made by burning a mixture of limestone and argillaceous rock, the latter being largely clay material. The composition of Portland cement is calcium oxide, silica and alumina. The raw products can be found in many localities in Burma. But before constructing a plant other factors must be considered among which are source of fuel, transportation facilities, and market.

At present there is a cement plant at Thayetmyo, a town on the lower Irrawaddy River. Before the war, it had a capacity of about 1,000 barrels per day or 60,000 long tons of cement per year, and was capable of supplying all of Burma's domestic needs, with a small surplus for export. This plant will probably soon be producing at its prewar capacity.

The construction of buildings, industrial plants, river projects and bridges will have to be expanded substantially if Burma is to progress economically as planned. Therefore, at least one new plant will be needed in the near future to provide for the additional demand for cement and cement products. Any new plant must be economically located. The increased demand should justify a new plant on the eastern side of the Central Basin, that is along the route between Pegu and Mandalay. Suitable raw materials should be found along the west boundary of the Shan Plateau. It is hoped that Kalewa coal can be delivered at Myingyan, at the junction of the Irrawaddy and Chindwin rivers, at a low cost. A plant at this location could supply the market from the lower Sittang Valley north to Myitkyina, and thus relieve the Thayetmyo plant of some of its domestic load and enable it to export a larger amount. This plant is located very advantageously for the export of its product.

A survey should be made to determine the future requirements of eastern Burma so that plans can be formulated as to size of plant needed, the best location for it, and the availability of the raw materials, and fuel.

g. Clays and Kaolin. Clay is of widespread occurrence wherever the rocks are predominantly of sedimentary origin, but not all is of such quality that it can be used for pottery, tile, and drain pipe, and common uses such as brick, etc. Only a pure, high-grade kaolin can be used for manufacture of chinaware, as a filler in paper and fabrics, and in bleaching.

Burma has a number of small pottery plants, most of which are located in the Central Basin area where the rock formations are of Tertiary age. The only plant operating on a commercial basis is at Rangoon. Its capacity is 5,000 dozen pieces per month. Since the demand is currently eight times this amount, the plant capacity should be expanded. The cost of production could thereby be reduced 50%.

The deposits of the Lower Chindwin District occur at the base of the Irrawaddy Series and have an areal extent of probably 40 miles. These clays contain 25 to 40 per cent kaolin. Such deposits warrant commercial exploitation.

In the Thaton District near Yinnyein (16°47′; 97°23′), in close proximity to the railroad, there is a clay deposit of possible importance; and near the military cantonment at Moulmein a fire clay deposit is reported. This latter, particularly, should be investigated so that if suitable for the making of firebrick, the market in Burma can be satisfied without relying on imports.

h. Fertilizers. No deposits of phosphate or phosphate-bearing limestone, potash minerals, nitre and guano have yet been reported as occurring in Burma. Phosphatic limestone might readily be passed over in any field examination unless samples are taken and a chemical analysis made. This should be done with all limestones wherein there is the slightest indication that phosphatic material might be present.

A super-phosphate is produced by the treatment of phosphatic limestone with sulphuric acid, the latter a product that will probably be made from the flue gases of the proposed zinc-reduction plant. Super-phosphates are highly valuable as fertilizers.

At the present time information is not at hand as to Burma's use of fertilizer. A study of future requirements is indicated and plans for production included in the Myingyan projects. Imports of all types of fertilizer have varied from Rs. 11,590 in 1946-47 to Rs. 3,33,003 in 1940-41.

i. Gem Stones. Rubies, sapphires and spinels are the most valuable of the Burma gem stones. The center of the mining industry has been and is now at Mogok, in the Northern Shan States, about 70 miles northeast of Mandalay. Mining was controlled almost exclusively by the Burma Ruby Mines Company from 1889 to 1932; since that time the mining has been administered by the Government of Burma.

The gem stones are found where intrusive granites have crystallized the limestones. Gneisses are also part of the country rock. Although the gem stones occur in the crystalline limestones, they are not mined from such but are mined from the detritus resulting from the weathering of the limestone in situ and from gravels in which they have been concentrated. The gravels may be reached by shallow shafts and then mined by drifts, or, where the gravels are a recent deposit, such as along streams or as valley fill, hand washing is done. Some gem stones may be found in fissures and caves in the limestone.

In the Sagyin Hills, north of Mandalay, rubies of a lighter color than those from Mogok have been found in clay-filled fissures in the limestone. The statuary marble, referred to under "Building Stone," is quarried here.

At Nanyaseik and vicinty, about 60 miles northwest of Myitkyina, 25°37′; 96°35′, ruby mining was active in the early part of the century, but is practically abandoned now.

A study of the Mogok region, including the area west to Shwenyaungbin and probably farther, might lead to suggestions as to favorable areas to prospect and certainly to the application of modern mining methods.

Other semi-gem stones found in the general Mogok region are Apatite, Aquamarine, Chrysoberyl, Moonstone, Peridote (Chrysolite), Garnet, Lapis Lazuli and Rock Crystal (Quartz). Rubellite, the red variety of Tourmaline, is found in a few places in the Northern Shan States, but principally in the Mogok region.

The gem-stone mineralization around Mogok is the result of metamorphic action of the granite intrusions on calcareous rock, as limestone. From Mogok north to the Sino-Burmese frontier other occurrences of gem stones may be hoped for wherever the granite is found intruded into limestone rock. South from Mogok, the mineralization resulting from such relations is wolfram (tungsten) and tin. This metal mineralization extends south through Tenasserim and into Siam and Malaya, and on to the tin areas in Indonesia.

j. Grinding Media. For the grinding of some minerals, flint pebbles have a decided advantage over steel balls. In the reducing of pottery clays, feldspar, silica sands and other similar materials the use of flint or similar type pebbles obviates the introduction of iron into the product. The sliming of material is not harmful in the beneficiation of many of the industrial minerals, and may be desirable in some instances. It would be deleterious to minerals prepared for gravity or flotation concentration. In such cases steel balls or rods are used as grinding media in order to minimze sliming.

Some flint pebbles are imported, although in small quantity. There probably are many mountain streams on the slopes of the Shan Plateau and in North Burma where rounded pebbles of required size and mineral composition could be gathered. This matter, even though it involves only a small tonnage, should be investigated with a view to saving foreign exchange.

Grinding pebbles imported from the U. K. are being used at the Burma Pottery Works at Thamaing, near Rangoon. This requirement could certainly be met with a Burma product at less cost and with a saving of exchange.

k. Gypsum. No deposits of commercial size are reported in Burma nor is there a large demand for gypsum. With an increase in construction, however, there should be an increasing market if the gypsum is in supply and at a proper cost. Gypsum is used as a retarding agent in the manufacture of cement. Aside from the needs of the present plant at Thayetmyo, a new plant in eastern Burma would double the present demand.

A small amount of gypsum is used for molds at the pottery plant in Rangoon.

The chief sources of supply will probably be in the Tertiary Basin rock formations. From a transportation standpoint such deposits would be handy to the cement plant at Thayetmyo and a probable second plant at Myingyan, 55 miles southwest of Mandalay. With power facilities available, gypsum-board plant might be built at Myingyan, if the raw product can be made available. Geological investigations should be made to determine the availability of an adequate source of gypsum to provide for all of Burma's requirements, and to encourage the establishment of new industries that would use gypsum.

l. Jadeite. No jadeite production is reported in 1950 and only 21.37 cwt., valued at Rs. 98,995 in 1949. As an industry, its production has almost ceased. The best grades are semiprecious stones of considerable value.

Jadeite is produced in four districts in Northern Burma, only in one of which is the jade found in its primary environment, that is, in dikes. This area includes the Tawmaw (25°41′; 96°15′)— Lonkin-Kansi triangle, about 70 miles northwest of Myitkyina. In the other three areas, the jadeite is found in Tertiary and Pleistocene or Recent conglomerates, and in residual boulders. The jadeite in the conglomerate type of occurrence was derived from the weathering of the original dike material and deposited as alluvium in earlier time.

Jade is an exportable product. Mining in the known jadeite-bearing rock formations should be encouraged and more modern methods introduced so that greater depths can be reached in the conglomerates. Prospecting for jade-bearing dikes may reveal new trends and new lodes. The host rock of the jadeite in the dikes is albite, a soda feldspar (sodium aluminum silicate).

m. Limestone and Lime. Limestone is found throughout most of eastern Burma, from the Tenasserim north. It is also found in places in the Central or Tertiary Basin.

Limestone is utilized in many ways; in Burma chiefly in the making of lime and as road metal and ballast. Some may be used in building and other types of construction, and a minor amount as a flux in metallurgical processes.

The lime that is made from the calcining of limestone, dolomite or other calcareous material has many uses in Burma, chief of which are in construction in the preparation of masonry mortars, stucco, plaster, in whitewash and in concrete. As noted elsewhere, cement is made from the burning of a mixture of limestone and argillaceous rock.

Crushed limestone and lime are used in agriculture to condition or correct soil acidity. Its use for such purpose in Burma is probably very limited.

Lime is produced at many places in Burma and consumed locally, with minor exceptions. The largest production is at Thayetmyo in the plant of the Burma Cement Company. A seasonal operation at Kyaikmaraw provides lime for shipment by small river boats to Moulmein, 12 miles to the northwest.

Other areas of lime production in sizable quantities

are the Zebingyi quarries, Tonbo Hill quarry and at Sagaing, all in the general Mandalay area; at Kamaing, Myitkyina District; Kyaukse District; Shagwe, Shwebo District; and at Maukthayet, Lower Chindwin District.

n. Salt. No solid beds of sodium chloride, or rock salt, are known to occur in Burma. Nearly all salt production is from the evaporation of sea water. This is a manufacturing process and is carried on in the Amherst District of Tenasserim, on a large scale. On a smaller scale similar operations are carried on in Thaton, Tavoy and Mergui in the Tenasserim; in Akyab, Sandoway, Kyaukpyu and Bassein on the Arakan Coast; and in the Hanthawaddy District in the delta area. The production from these sources is hardly adequate and, should industrial use of salt increase, facilities must be expanded.

There are a number of places in central and northern Burma where natural brines occur. Sodium chloride, or common salt, is the chief product recovered but other valuable salts are also present. Near Bawgyo, Northern Shan States, 35% of the mineral content of the brines is sodium sulphate. Evaporation of the brines will probably continue as a local industry but the recovery of minerals other than sodium chloride should be encouraged.

o. Sodium Sulphate. If paper pulp is to be made in Burma, Glauber's salt, or sodium sulphate, is needed. One-tenth ton of Glauber's salt is required per ton of pulp produced. A small 40-ton pulp mill would, therefore, use 4 tons per day.

As stated under "Sulphur", when an electrolytic zinc refinery is built sulphuric acid for all of Burma's requirements can be produced. Until such time, small needs for sodium sulphate might be met by evaporating the brines from such sources as Yega Lake, seven miles north of Sagaing, near Mandalay, and the waters near Bawgyo, Northern Shan States. In the former the sodium sulphate content is 55.81%; in the latter 35.44%.

There are other areas in the upper Tertiary basin that might warrant investigation of the possibility of recovering "salts" from brines, should industrial requirements not be met from more readily available sources.

p. Sulphur. There are no known deposits of native sulphur in Burma. There are a few superficial incrustations and springs that contain hydrogen sulphide that occur in the Pakokku District, but they are of no economic value. In early times sulphur is reported to have been extracted from nodules of pyrites, with the center of the industry at Mawson in the Southern Shan States. Pyrite contains 46.7% iron and 53.3% sulphur. No large deposits of pyrite in Burma are known.

Recommendations are being made for the construction at Myingyan of an electrolytic zinc plant and a plant for the recovery of sulphuric acid.

The sulphuric acid could be used in making sodium sulphate and sodium sulphide, both needed in paper pulp manufacture.

The sulphuric acid could also be used in making a super-phosphate for fertilizer, if phosphatic limestone could be found.

q. Talc or Steatite. Talc was produced at one time from deposits that occur about 45 miles southwest of Minbu, a town on the Irrawaddy River. The talc occurs in veins and is associated with serpentine rock. These mines were abandoned some years ago. Since there are numerous occurrences of serpentine in the Arakan Yoma, other deposits of talc may be found in this association. There is a world demand for high-grade talc and it might prove to be a profitable export product.

4. COAL IN BURMA.

a. Uses and Consumption. Coal is traditionally imported from Bengal State, India. Prewar imports were:

1938-39	373,906	tons
1939-40	428,695	"
1940-41	494,275	"
1946-47	173,854	"
1947-48	138,786	"
1948-49	82,076	"
1949-50	103,569	"
1950-	121,041	"

Consumption was abnormally high for the years 1939 to 1941. The average of 1937 to 1941 is stated to have been 366,000 tons per year[1], including coal and coke. Coke imports have been as follows:

1939-40	39,641	tons
1940-41	28,038	"
1947-48	1,265	"
1948-49	5,769	"
1949-50	12,678	"
1950-	772	"

Average normal prewar consumption is believed to have been about 350,000 tons per year. Of this tonnage, the railroad was the largest single consumer, using 180,000 tons a year. The balance was divided between the Irrawaddy Flotilla Company, Ltd., with over 100,000 tons, the Rangoon electric plant, the Rangoon pumping plant, and other industries.

The present diminished consumption of 100,000 to 120,000 tons per year is divided into about 20,000 tons for the Rangoon power plant, 13,000 tons for the I.W.T.B. (Inland Water Transport Board), 8,000 tons for the Port Commission, 5,000 tons for the Rangoon pumping plant, and most of the balance for the railroad.

Indian coal as now used is a low-volatile, high-ash bituminous coal with a high sulphur content. The fol-

(1) Pitt W. Hyde: Proposed Plan for a National Coal and Coke Industry, Sept. 1, 1951.

lowing analysis was furnished by the Rangoon power plant

Moisture	6.0%
Volatile	24.0%
Fixed Carbon	54.0%
Ash	18.0%
Sulphur	2.9%
Btu	11,680

No figure was given for ash fusion temperature, but the ash is said to clinker badly. It is used in the Rangoon power plant on chain-grate feeders. Elsewhere, so far as known, it is hand fired. The range of prices, f.o.b. Rangoon, in recent years, has been:

1948—Rs. 70/10/6 per ton
1949—Rs. 66/10/6 per ton
1950—Rs. 63/ 2/0 per ton
1951—Rs. 83/ 7/0 to Rs. 96/6/0
1951—since November 5—Rs. 90/3/0

Various grades of coal are furnished, with no difference in price but regulated by allocation, with ash content of 15 to 35%. Railroad and power plant coal appear to average between 20 and 22% in ash content. The coal supply from Indian appears to be ample though it is very difficult to get the better grades.

Coke is also imported from India. The present price range is Rs. 105/- for low-grade, high-ash coke, to Rs. 125/- for foundry grade. In prewar years the principal coke consumer was the Burma Corporation, for its Namtu smelter, with some 25,000 tons per year. Their future requirements may be around 5,000 to 10,000 tons per year.

All coal imported into Burma is handled under government control by a group of former importers, with Heilger's Ltd., as their agent.

Compared to prewar consumption, the trend of coal demand is downward for river boats, and upward for power plants and industries. Indian coal at present prices is close to a balance with fuel oil which costs Rs. 160/- per ton to the lower plant. The railways are not equipped for using oil and there are, as yet, no diesel locomotives. Unless a domestic source of coal is developed, the railways are likely to turn to diesels. Considering these trends, the future normal coal consumption is estimated at the prewar figure, 350,000 tons per year. It may be reached by 1960. After that, an increase of possibly 10% per year should be provided for, if industrial activity should increase at the anticipated rate.

b. Geology. Geologically, coals in Burma are of three ages: Jurassic, early Tertiary (Eocene), and late Tertiary.

Eocene coals outcrop along the west side of the central Tertiary Basin from Henzada, in Lower Burma, to near Myitkyina. They are mainly a band of coal measures of the Yaw series, overlain by the Shwezetaw sandstone of the Pegu series which makes an excellent marker for the top of the coal measures. The coal measures are from a few hundred to 2,000 feet thick. The Kalewa coal is in the Yaw. The coals are subbituminous, and range from 10% to 16% moisture, except where local deformation has devolatilized them and reduced the moisture content.

Jurassic coals are found in the Southern Shan States in narrow, broken bands with north-south trends. They were highly contorted by the intense folding of the late Cretaceous-early Tertiary time. Probably most of them have eroded away. Tortuous remnants remain, usually near vertical, highly metamorphosed and devolatilized. Some of the coal is cokable, due to partial devolatilization. The Jurassic coals have little commercial interest except for the probable coking quality. It is possible that some bed may be found with an exploitable amount of coking coal. The moisture content is very low and they rank as bituminous coal or semi-anthracite.

The subbituminous coals of the Northern Shan States are late Tertiary—possibly Pleistocene. They are higher in moisture content—15% to 20%—than any other coals in Burma and, therefore, are of less value. They may be useful for local consumption, such as steampower generation or for metallurgical purposes where a coal of this low rank may be used.

c. Coal Deposits. A list of the more important and better known coal occurrences follows. Each is located by latitude and longitude and the number corresponds to the number on the key map showing the geographic location. The analyses are recorded, for brevity, as M, V, FC, A, Btu, for moisture, volatile matter, fixed carbon, ash, and British thermal units.

Kalewa—Map Location 1: 23°12′; 94°16′ Upper Chindwin. More completely described under "Kalewa Coal Project". Upper Eocene coal measures lie below the Pegu sandstone, the measures are about 2,000 feet thick with numerous coal beds up to 13 feet thick, dipping 38 to 48 degrees east. One seam shows considerable persistence going north from the Myittha River, and is from 8 to 13 feet thick. Analysis of a sample taken from a shaft at 80 feet down the dip shows M-13.4, V-40.9, FC-41.8, Ash-3.9, Sulphur 4.42, Btu. 11,027. Other seams range up to 6 feet in thickness. Similar showings with one wide seam are reported in the Nantahin and Peluswa valleys, 12 and 25 miles north, respectively, on a continuation of this formation. The outlook for a large tonnage of this subbituminous coal is indicated by a marked regularity and continuity of the coal-measures formation.

Kalaw-Loi-An—Map Location 2: 20°35′; 96°34′ Southern Shan States. An outcrop of Jurassic coal is folded within the Plateau limestones. The coal formation

is contorted, irregular and discontinuous, and the dip is nearly vertical. Cotter reported 20,000 tons proved, in 1921, by a company which undertook to develop the field. The coal is a low-volatile bituminous of coking quality. Analysis is M-0.8, V-26.4, FC-61.5,. Ash-11.3. Operations in 1922-24 failed due to high mining cost and mining difficulties. This field was considered a possible source of coking coal, but a field inspection shows that the possibilities of an important tonnage are slight.

Theindaw-Heinla-Htiphanko—Map Location 3: 12° 20′; 90°08′ Mergui District. This is a small basin of Tertiary coal bordered by Carboniferous limestones. It has been prospected at the three places named, along the west bank of the Greater Tenasserim River. Thicknesses of 7 feet and even 28 feet are reported, but the seams thicken and thin in short distances, with a considerable lack of continuity. A typical analysis is M-10.8, V-27.4, FC-42.5, Ash-19.3. Tests in a steam launch gave satisfactory results. The field has been prospected several times and a syndicate was organized to develop it in 1921, but failed. It is possible this field might be developed as a local source of fuel in the Mergui District. It is unlikely to prove large enough to supply any considerable part of Burma's fuel needs.

Bhamo-Mithwe—Map Location 4: 24°05′; 96°59′. Narrow Tertiary seams, highly disturbed and crushed

Henzada-Hlemauk—Map Location 5: 17°50′; 95°06′. Kywezin (17°58′; 95°09′), Posugyi (18°10′; 95°07′). Near Prome. Tertiary coals, mostly thin but reported 8 feet thick at Kywezin where it is considerably crushed and otherwise deformed. It shows a low volatile, bituminous quality at this place, probably due to local deformation. Analysis is M-1.7, V-17.6, FC-74.4, A-6.3. This might be of coking quality and is worth examining with this in view.

Hukawng—Map Location 6: 26°29′; 96°59′. Upper Kachin State. Tertiary coal, one to four feet thick. Analysis M-1.5, V-45.6, FC-46.2, A-6.7. It is reported to make good coke. Although remote from transport by rail or water (about 20 miles from Ledo Road), it may have some value in the future due to its reported coking quality. The high volatile content shown in the analysis makes this deposit questionable as to coking quality.

Katha-Pinlebu, Kyobin—Map Location 7: 23°34′; 95°16. 130 miles northwest of Mandalay. Three seams up to four feet in thickness are exposed over a wide area, covering some 30 square miles. The structure is complicated; beds are folded and faulted. Typical analysis, M-4.3, V-30.3, FC-58.8, A-6.6. Locomotive tests resulted in satisfactory performance. A 24-mile railway to the Mandalay-Myitkyina line would be required. This is a high-quality bituminous coal and should be examined further, although the thinness of the seams and their irregularity are adverse factors.

Minbu-Kyaukset—Map Location 8: 20°02′; 94°38′. 4′ - 7′ seam, dip 55 degrees. Analysis, M-7.6, V-35.5, FC-52.8, A-4.1, 10,350 Btu. Typical Tertiary coal of the west side of the Central Basin; similar to Kalewa coal.

Myitkyina-Hwehka-Tarongyaung—Map Location 9: 25°29′; 96°26′. Tertiary seams, dip 75 degrees. Analysis, M-7.3, V-20.0, FC-37.8, A-34.9, non-coking.

Pakokku-Yaw River—Map Location 10: 21°18′; 94°20′. 5 to 6 foot seam with shale partings. Tertiary coal. Analysis, M-18.7, V-34.1, FC-35.9, A-11.3.

Lashio —Map Location 11:20°56′; 97°47′.
Mansang —Map Location 12:22°26′; 96°58′.
Mansala —Map Location 13:22°40′; 98°16′.
Namma —Map Location 14:22°42′; 97°52′.
Wetwin —Map Location 15:22°05′; 96°38′.

All these five are in the Northern Shan States and quite similar in character. Typical analyses range from M-16.6, V-36.9, FC-38.8, A-7.7 to M-20.6, V-35.6, FC-31.1, A-12.6. All are subbituminous Tertiary coals. Some seams are very thick—Namma, 7 to 17 feet, up to 30 feet thick at Lashio. Often 4 to 6 feet thick. There is said to be 5½ million tons proved at Namma. Fifty tons of Namma coal was tested by Babcock-Wilcox and pronounced satisfactory for pulverized fuel or for chain-grate stokers. Locomotive tests, as on all the subbituminous coals in Burma, were unsatisfactory. There is unquestionably a very large tonnage of coal in this district, and the coal would be useful if none better were available. Actually, it is unlikely to be used except possibly for industries or mines in the immediate vicinity since it compares unfavorably with Kalewa coal.

Legaung—Map Location 16: 20°50′; 96°33′.
Panlaung—Map Location 17: 21°03′; 96°24′.
Pwehla—Map Location 18: 20°51′; 96°43′.
Thamakan—Map Location 19: 20°42′; 96°42′.
Loi-An—Map Location 2: 20°35′; 96°34′.

All these coal occurrences are in the Southern Shan States. All are quite similar to the Loi-An coal (see Loc. 2).. They are highly distorted, often being metamorphosed into low-volatile or near-anthracite grade. Probably all are of Jurassic age and were subjected to intense folding in the late Cretaceous and early Tertiary times. Many have coking qualities and would be excellent steam coals if enough tonnage could be developed for practical operation in any one place. The degree of metamorphism exhibited at the outcrops varies with the intensity of the folding to which the area has been subjected.

Shwebo-Kabwet, Map Location 20: Including Thinbaung, Kyibin, Thingadaw, Letkokpin, Kyetsubin — 22°44′; 95°59′. Tertiary coals, similar in quality to Kalewa coal. Thicknesses from 3 to 6 feet. Analysis of

coal from Letkokpin: M-11.9, V-37.7, FC-36.2, A-14.2. This field was operated by the Burma Coal Co. from 1870 to 1904, hauling coal in ox-carts 24 miles to the Mandalay-Myitkyina railway. Production was 10,000 to 15,000 tons per year, with a maximum of 23,000 tons in 1896. Presumably the coal was used in railway locomotives. This field may have coal very similar in quality to the Kalewa coal. The seams are thinner, however, evidently higher in ash, and the field is less accessible, requiring a railway extension of 25 to 30 miles for transport.

Thayetmyo—Map Location 21: 19°16′; 95°11′. 5 miles south of Thayetmyo. Tertiary coal up to 4 feet thick; dip 75 to 80 degrees. Analyses: M-2.5, V-30.2, FC-64.1, A-31; M-6.0, V-32.9, FC-45.4, A-15.7. Some indications of coking quality. Formerly worked on small scale. Not far from the Irrawaddy River. This coal has evidently undergone some devolatilization from the folding of the strata. It is probably in the same series as the Kalewa coal. It might have some application in the Thayetmyo cement mill which now uses natural gas for fuel. Also, it is worth looking into as a possible source of coking coal, although a four-foot seam standing nearly vertical would be expensive to mine.

Loikaw-Mong Pai—Map Location 23: 19°42′; 96°59′. This was examined briefly in October by St. Clair and Bennett. Dips are nearly vertical and the coal is considerably crushed. One seam is reported to be four feet thick. Analysis of a sample from this gave M-1.6, V-40.0, FC-39.3, A-20.1. This is probably a Jurassic coal similar to the Loi-An deposit near Kalaw, and, as such, is likely to be irregular in occurrence. However, because small-scale tests showed that it has coking characteristics, it should be further investigated.

d. Recommendations. Immediate exploration of the Kalewa coal field is recommended and detailed under "Kalewa Coal Project." If it should result as anticipated, the normal solid fuel requirements of all Burma will be met. Development of other fields such as the Mergui (Theindaw), the Thayetmyo, and Namma prospects may be considered for purely local requirements, such as power plant, cement mill, or brick and tile factory.

There has still not been discovered any important deposit of coking coal in Burma. It is recommended that the Jurassic coals of Loikaw and Southern Shan States be examined with the thought of locating a possible source of coking coal. A million or two tons of such coal, even though expensive to mine, would be important to the Burmese economy.

e. Sources of Information. The Loikaw, Kalaw and Kalewa fields were examined on the ground, briefly. Five days were spent in the Kalewa field. Other information sources are:

(1) Dr. Ba Thi, memorandum to ECAFE, 1950.
(2) Clegg, Mineral Deposits of Burma, 1944.
(3) Chhibber, Mineral Resources of Burma, 1934.
(4) Simpson, Coals of Northern Shan States, GSI XXXIII, 1906.
(5) Noetling, Upper Chindwin Coal Fields, GSI, 1893.
(6) Noetling, Coal Fields of Northern Shan States, GSI XXIV, 1891.
(7) Jones, Fox—Reports on Kalewa Coal Field, GSI, 1929.
(8) Cotter, Report on Loi-An Coal Field (Kalaw), 1922.
(9) J. Coggin Brown, Reports on N. Shan Coal Fields, 1914.
(10) P. W. Hyde, Proposed Plan for National Coal & Coke Industry, 1951.
(11) Heron, Report on Prospecting Mergui Coal (Theindaw), 1892.

5. PETROLEUM INDUSTRY.

a. Introduction: Prewar petroleum industry was the third largest in Burma. Its importance in the economy of Burma can be seen from the fact that it gave employment to about 20,000 workers in 1942 and Government annually collected about Rs. 36 lakhs as royalty and acreage fees. The average annual value of crude oil produced for the last few years before the war was about Rs. 6 crores. It has been estimated that on the average the total value of refined products was about Rs. 15 crores. The refined products produced in Burma were more than sufficient to satisfy Burma's needs. In fact the bigger portions of them were exported, almost all to India except for wax, which was mostly sent to United Kingdom. Nearly 5 million barrels of liquid products went to India and sales in Burma in 1939 amounted to 830,000 barrels.

b. History. Petroleum is found in Burma, in Arakan and along the line of the Irrawaddy-Chindwin Valley. In Yenangyaung and Arakan it has been worked for centuries by primitive methods. During the late seventies of the last century attempts were made, but without success, to develop the Arakan field. The production from this field has never been big. The Burmah Oil Company holds a prospecting license over Olah Taung area in the N.W. corner of Arakan which may perhaps turn Arakan into an important oil producing area.

The modern petroleum industry began in Burma in 1886 when the Burmah Oil Company, the parent of the present company, was formed to exploit the Yenangyaung field by buying well sites from the Twinzas and obtaining leases from Government over neighboring areas. The first machine-drilled well commenced by that company in Khodaung was completed in 1889. Various other companies tried to enter the field, some with success but

mostly with failure until at present only a few remain with the Burmah Oil Company dominating. Their relative shares in production prewar were B.O.C. 75%, I.B.P.C. 12½%, B.B.P.C. 9½% and N.O.C. and others 3%. Operations were extended to other areas such as Yenangyat, Chauk, Minbu, Palanyon, Yethaya, Padaukpin, Yenanma, Lanywa, Indaw, Tagaing and Sabe, all of which were later proved for oil. Burma's petroleum production thus rose from a modest figure of about 2½ million gallons in 1888, mostly from hand-dug wells, to the peak production of 296 million gallons in 1921. Burma was producing at the rate of about 275 million gallons of crude oil a year for the last few years before the war.

In 1942, on the evacuation of the British from Burma, the oil companies, before they left, damaged the wells, the refineries and the pipe lines to deny their use to the Japanese. The once-prosperous oil industry was almost extinguished.

c. Conditions in the Fields. At the end of the war the oil companies came back and were carrying out the rehabilitation task enthusiastically, with the major oil companies—B.O.C., I.B.P.C. and B.B.P.C.—working together with the idea of ultimately forming a merger. About the middle of 1948 for various reasons the work came more or less to a standstill. Conversely, other countries like the Dutch East Indies and Borneo, which had also suffered the ravages of the war, not only rehabilitated their oil industries but their progress has been such that their prewar production rate has been exceeded. In Burma the annual production of crude oil is still a fraction of what it was prewar, as shown in the following table:

Year	*Production in gallons*	*% Average Prewar Production*
1947	8,000,000	3%
1948	12,000,000	5%
1949	8,000,000	3%
1950	16,480,000	6%

The oil companies came back with the idea of producing 10,000 barrels of crude oil per day from the oilfields and processing it at refineries to be concentrated at Syriam. The refineries have not yet been built, the reason given being that the completion of the erection of the refineries has been scheduled to coincide with the putting into commission of the main pipe line from the oilfields to Syriam. Although the rehabilitation of the part of the main pipe line between Chauk and Nyaunghla was completed by 1948, the part from Nyaunghla to Syriam still remains unrehabilitated. As regards the oilfields, although at Chauk-Lanywa almost all the wells have been reconditioned, not much rehabilitation has been accomplished at Yenangyaung and practically none at the other fields. Even at Chauk the ancillary production equipment such as the gas system, pumping power and lines, and oil and gas lines is far from being completely rehabilitated. At present the Associated Oil Companies are producing from about 35 wells in Chauk and 5 wells in Lanywa to feed their distillation unit at Chauk. In Yenangyaung field Nathsingh Oil Company is producing from half a dozen wells and the Twinzas are producing from some of the wells which were formerly leased to the Associated Oil Company and which have been returned to them. Production from these sources together with the production from hand-dug wells amounts to about 2 million gallons a month.

d. Refining Capacity. The Associated Oil Companies are at present operating a distillation unit with a capacity of about 2,000 barrels per day. The amount of products obtained is far from sufficient to supply the needs of Burma and Burma is at present importing petroleum products. As an interim measure the Associated Oil Companies are building an additional distillation unit at Chauk which will have a capacity of 2,500 barrels per day. It will include a wax treating plant. The construction consists of salvaged plant materials from Syriam, Seikkyi and the fields with some new equipment from abroad. The Union Government is purchasing one-third of the assets of the Associated Oil Companies to join in partnership in the production and refining of the petroleum.

e. Geology. All the important oilfields of Burma are situated in the areas which lie between the Arakan Yoma —Chin Hills on the west and the Shan Hills on the east. This area, known as the Burma Tertiary Basin, is composed almost solely of rocks of Tertiary age which consist predominantly of sandstones, shales and clays.

South of latitude 22°, the Pegu and Eocene rocks generally consist of an alternating succession of sandstones and shales or clays, with subordinate grits, conglomerates and foraminiferal limestones. Although most of the beds are marine, locally they are deltaic or fluviatile. There is considerable lateral variation, beds generally become more sandy and less marine northward, but there are many local exceptions.

Pagu and Eocene rocks north of latitude 22° are composed of massive sandstones, grits, conglomerates, mottled clays and alternations of sand and clay. They appear to be largely freshwater deposits.

Correlation between the Pegu and Eocene rocks north and south of latitude 22° is still very uncertain.

f. Structural Units. The Burma Tertiary Basin is composed on four structural units, (1) the Northern or Chindwin basin north of latitude 22° separated by a traverse uplift from (2) the Central, or Minbu, basin between latitudes 22° and 19°30′ and (3) the Southern, or Delta, basin south of the uplift at 19°30′ and (4) the uplift of the

Pegu Yoma with its northern extension as far as latitude 24° The first three are separated from the fourth by a volcanic line.

g. Oil Sands. Numerous oil and/or gas shows occur in all the rocks varying from Eocene to Middle Miocene. They are rare to the east of the folds which form the eastern boundary of the main syncline. They are almost entirely confined to the Eocene north of Sabe and occur at higher and higher horizons between Sabe and the Prome District. Oil showings occur only in the Eocene and the lower part of the Oligocene in the outcrops on the west side of the Minbu Basin. It is in rocks of Oligocene and Lower Miocene age that oil has been found in commercial quantities so far.

h. Location. All the oilfields are situated in the Central Basin except Indaw, which lies in the Northern Basin. Most of the oilfields and all of the principal ones are on the first anticlines which rise to the east of the main syncline except Padaukpin, which lies on the south and Yenanma, which is a monocline and lies on the western side of the main axis of the Minbu Syncline. The principal fields are in domes along one main line of folding centrally situated within the Minbu Basin and which extends from Yenangyat to Yenangyaung. Although there are many other folds in the oil belt, production on a commercial scale has so far been obtained only from those anticlines which lie along the edge of the main synclinal areas.

i. The Oil Fields. Listed below are the fields that have been productive.

(1) Yenangyaung: The field is in the Magwe District and lies two miles east of the Irrawaddy. It is a slightly asymmetrical elongated dome about six miles long and one mile wide. There are about 50 sands. Production is found as deep as 5,500 feet. The wells today average 2.9 barrels. 1942 production was 105,850,000 gallons and the total production from the field is 6,120 million gallons.

(2) Chauk or Singu: The field is in Magwe District on the east bank of the Irrawaddy. It is an asymmetrical elongated dome. There are about 35 sands; the production today is coming from 1,200-1,500 feet. The deepest test so far made reached 5,800 feet. Average well production is 13.9 barrels. Production in 1942 was 150,-657,400 gallons.

(3) Lanywa: This field is a structural continuation of the Chauk field and lies across the river to the north. The oil-bearing sands are at depths of 1,700 to 3,800 feet. Average production per well in 1942 was 19.2 barrels. Annual production is included with Chauk.

(4) Yanangyat: The field lies along the west bank of the Irrawaddy in Pakukku District. The structure is a faulted, asymmetrical anticline en echelon with Chauk-Langwa. It extends about 29 miles and has a maximum width of about 3½ miles. Oil sands are found to a depth of 4,200 feet.

(5) Indaw: This field is in the Upper Chindwin District, some 175 miles north of Chauk. It is a gently folded dome; the sands are found at depths from 800 to 1,200 feet. Tests have been made to 3,000 feet; heavy gas pressure is found at depth.

(6) Minbu: The field is on a faulted anticline about 20 miles long. The chief oil sands are found at a depth of from 450-750 feet. Average well production is 1.1 barrels.

(7) Yenanma and Padaukpin: There are two small oil fields in Thayetmyo District. Yenanma is on a monoclinal structure; depth to sands, 600-700 feet. Average output per well is 4.2 barrels. Padaukpin is a flat-topped asymmetrical dome eight miles northwest of Thayetmyo. Both of these fields have small production.

j. Reserves. The oil reserves of Burma in the presently-known fields have been estimated to be about 90 million barrels. This is small compared to reserves in other countries. At the optimum rate of production of 10,000 barrels per day, as envisaged by the Associated Oil Companies, the fields would be exhausted in just over 20 years' time. However, reserves may be increased by the application of secondary methods of oil recovery to the known fields, by their extension laterally and in depth, and by the discovery of new oilfields.

k. Potential Areas. The prospects for finding new oilfields in Burma are favorable. In the three structural basins of the Burma Tertiary Basin, the areas bordering them and also deeper sands in the existing oilfield which have not yet been thoroughly prospected, there are about 50 exposed geological structures suitable for the accumulation of oil pools. Although the prospecting of these exposed structures will probably not lead to the discovery of any major oilfield as productive as Yenangyaung or Chauk, there are alluvial areas in all these basins where the underlying structure is hidden. The largest among them is the Irrawaddy Delta. Others are the Shwebo area and the area which lies west of Yenangyaung. In these alluvial areas, new major oilfields may be discovered through the application of geophysical methods of prospecting. The Irrawaddy Delta south of latitude 20° is the largest area and probably the most promising for discovery of large oil structures.

l. Engineering Methods. Regarding secondary methods of recovery, the oil companies built up a comprehensive policy of gas conservation and, in areas where gas and oil were intimately associated, measures were taken to restrict to the practicable minimum the amount of gas produced with the oil. This was effected by maintaining back pressure on producing wells. In some cases, gas

unavoidably produced with the oil was re-injected into the oil sands.

In Yenangyaung oilfield, the major companies operating with the Reserves cooperated in applying back pressure on youthful wells. There was some repressuring by gas injection and a large number of gas drives were maintained in shallow and moderately deep sands. In the Reserves, production was also taken under a vacuum of up to 10½ inches of mercury.

At Chauk also, major oil companies made adjustments at each well which led to maximum oil recovery with minimum production of gas. Wells with high gas-oil ratios were shut in and the balance of casing-head gas remaining after the satisfaction of the field requirements was returned to dry gas sands for storage or to certain areas for repressuring purposes. When full-scale operations are resumed, The Associated Oil Companies intend to return to the sands all excess gas, after allowing for necessary fuel requirements. It has been found that water in the Chauk field does not have free circulation with any outside source. As the oil is produced and the pressure reduced, the water table advances up the structure. Such is termed a water-drive field. The possibility of hastening the natural water advance by injecting water through a marginal line of wells and thereby increasing the oil flow is being considered by the Associated Oil Companies.

Back pressures were maintained on nearly all the wells in Lanywa field and also in Indaw. An experimental water drive was inaugurated prewar by the B.O.C. at the Minbu field.

m. Summary. In round figures, Burma produced in prewar years 270,000,000 imperial gallons of petroleum, the value of which was about Rs. 6 crores. The refined products had an average value of about Rs. 15 crores. The refined products required in Burma were about 12 per cent of the total, or about 830,000 barrels, thus leaving about 6,000,000 barrels for export.

By the year 1950, domestic consumption had increased to about 1,380,000 barrels of refined products and production had declined to about 470,000 barrels of crude. Hence, imports of over 900,000 barrels of petroleum products were required.

The present objective of the oil companies is a production of about 3,650,000 barrels of crude per year. When refined this will meet Burma's present requirements and provide for a substantial export.

If the petroleum industry, producing and refining, were returned to its prewar status, it would provide one of the more important sources in the expansion of foreign exchange. The Government, now a co-owner of the petroleum industry, should have the planned objective of putting the industry back on its prewar-production basis as soon as practicable.

At the proposed rate of production of 10,000 barrels of crude daily, the known reserves of 90,000,000 barrels will be exhausted in something over 20 years. At the prewar level of production, the life of the fields would be but 10-odd years. The necessity of intensive exploration work is obvious. For every barrel of oil pumped from the fields, at least one barrel of new oil should be proved, otherwise depletion will eventually result in the death of the industry

A study of the present position of the oil industry and an assessment of potentially productive areas, followed by geophysical and other types of geologic survey, appear desirable and such steps are recommended.

C. ESTABLISHED MINING OPERATIONS.

1. BURMA CORPORATION (1951) LIMITED.

a. Introduction. The history of the exploitation of the ore deposit at Bawdwin dates back to the 14th century with Chinese operation up to 1868, at which time the great Mohammedan rebellion in Yunnan caused the Chinese to abandon further work at the mine, except for their employment as mine labor in more recent years. The early Chinese worked primarily to obtain silver. Uses for the other metals, possibly excepting the lead, and their extraction from the ores were later developments.

Europeans became connected with the enterprise about 1900, and have continued the operation ever since.

The mine, the smelter and the concentration plant at Namtu were put out of commission at the start of the last war, and the mill was completely destroyed by fire just one night prior to reoccupation by the allied force in 1945.

At present, the mine is being cleaned out, timbers are being replaced and general rehabilitation work is being carried out preparatory to the resumption of ore extraction operations. A rebuilt concentrating mill with a capacity of 8,000 tons per month, or 20% of that of the former plant, is ready for operation. The smelter has been largely repaired and one of the five furnaces is in operation part of the time, that is when ore is available.

In December 1951, the Burma Corporation, Ltd., ratified an agreement with the Burma Corporation (1951) Limited, whereby the former sold to the latter its entire holdings in Burma including the Bawdwin and Namtu properties and related enterprises, such as the railroad, the hydro-electric power station, etc. By this transaction, a new English concern, Burma Mines, Limited, receives half of the stock of the Burma Corporation (1951) Ltd. and the Government of the Union of Burma subscribes for the other 50% of the stock of the new 1951 Cor-

poration, paying an amount for it equal to the valuation of the assets in Burma as set by the appraisal engineers. This valuation was Rs. 3,15,97,300. Management remains in the hands of the newly organized English company and the Board Chairman continues to be its appointee until the Government has fully paid for its 50% participation.

The problems before the management today are those of rehabilitating the mine so that regular production can be started and the mill and smelter kept supplied; planning enlargement of the concentrating mill; obtaining equipment to replace furnaces and other parts in the smelter, only one furnace now being in operation part time; replacing bombed-out equipment at the Mansam hydroelectric power station; and providing ample rolling stock on the company-owned railroad. The problems are further complicated by the labor supply situation that confronts the management.

There are reference works in which the geology is explained, the ore minerals described and the occurrences of the ore bodies discussed. There is no need for repetition here except for a few essential facts.

b. The Bawdwin Mine. The rock formations in the immediate area of the Bawdwin Mine are the Bawdwin volcanic series composed of rhyolite and rhyolite tuff. It is the latter that was the controlling factor in the formation of the ore bodies. The Marmion shaft is sunk on the tuff and after passing through it and into the underlying sediments, the mineralization is found to cease abruptly at the contact. The rhyolite itself is also barren of mineralization, only the tuff being the favorable host rock.

The major structural feature of the area is the Lilu overthrust fault which has a general north direction with a branching arm running northwest from a point some five miles south of Bawdwin. It is in the arm extending north that the Bawdwin ore body occurs where the rhyolite and tuffs have been folded into a dome and exposed at the surface.

Several faults parallel the major Bawdwin fault and were formed at the same time that the parent movement took place.

Following the inception of these faults, mineral solutions coursed through the shear or fracture zone, replaced much of the shattered rock and deposited the metallic contents of the aqueous solution in disseminated forms on the outer edges of the disturbed zone and almost solid sulphide in the interior, but only in the tuff where alteration made conditions conducive to mineral deposition.

After the ore deposit was formed, a later series of faults offset the major ore body and formed three divisions known as the Shan lode on the north, the Chinaman or main ore body in the center, and the Meingtha on the south. The movement in post-mineralization time was more horizontal or tangential than vertical. No mining problems are involved in going from one ore body to the other.

The Bawdwin ore body is one of the largest and richest ever found. The shear zone is about 8,000 feet long and 400-500 feet in width along the eastern branch of the fault. The ore body itself is about 3,000 feet long and is well-defined. The gangue is the metamorphosed tuff rock and some quartz. In the center of the ore shoot the ore is almost solid sulphides for a width of 140 feet, a rare and spectacular occurrence.

The major ore minerals are lead and zinc and silver, with associated copper, nickel, antimony and cobalt. The lead and zinc sulphides bottom at the contact with the underlying sediments. This takes place about the 10th level at 1,190 feet.

In the Shan and Meingtha lodes, north and south of the central Chinaman lode, the bottom part of the ore shoot is mostly copper sulphide. Although the ore bottoms on the sediments, the faults themselves extend on below the tuff to an undetermined depth.

The zinc values decrease from the higher levels downward. The lead content remains fairly constant from top to bottom. The silver values follow the zinc trend and decline with depth.

The most important fact to keep in mind is that the ore body in the Bawdwin mine has bottomed at the contact with the underlying sediments. The reserves of the blocked-out area are something over 3,000,000 tons (Jan. 1, 1941, 3,165,745 tons). To increase these reserves new ore bodies must be found in other fault areas, or the present ore bodies must be extended laterally from the known deposits. The extent of the main faults and the intensity of the shear zone would indicate that there may be a number of paralleling fractures in the rhyolite tuff, either where the tuff is exposed or where still buried. These may be mineralized also. Old trails, surface cavings, small patches of slag at many places around the country, but still in the general fault area and shear zone, are indicative that early Chinese miners had found small vein stringers over a rather wide expanse of country. If these may be accepted as criteria, there may be many other deposits in the general Bawdwin area that would add many more millions of tons to the present known ore reserves.

c. Concentrating Mill. The present capacity of the mill is 8,000 tons per month. The products are lead and zinc concentrates; the latter contain about 56% zinc and are shipped to the U.K. without further processing. The lead concentrates are charged to the blast furnace along with lead slag in proportions of one part lead to 1½ part slag.

The plan is to increase the capacity of the mill so as to handle about 150,000 tons of mine ore per year.

d. The Namtu Smelter. The smelter is being reconditioned to provide capacity for handling output of the concentrating mill, and, when the mill is enlarged, to smelt the increased production so as to produce at not less than one-third of the prewar rate and maybe up to one-half.

The output of the smelter is refined lead and silver, nickel speiss, copper matte and antimonial lead. The last three are shipped to the U.K. for recovery of the contained metals.

Lack of power has so far negated any thought of reducing the zinc concentrates to zinc metal in Burma and producing sulphur or sulphuric acid as by-products. With execution of the proposed plan for an industrial center at Myingyan, the production of zinc metal and sulphuric acid in Burma may become an actuality.

e. Mansam Falls Hydro-electric Plant. The power plant is located on the Nam Yao River, 20 miles southwest of Lashio and 25 miles southeast of Namtu from whence the transmission line continues 12 miles to the mine at Bawdwin.

Prewar, the Mansam plant, at the foot of a series of falls, had a capacity of 10,000 kw. and the upper plant at Kunnyaung 2,000 kw. This plant was destroyed and will probably not be rebuilt. The Mansam plant is being repaired. Only one unit of 2,000 kw. is now in use but additional equipment is in Rangoon to be shipped as soon as delivery is assured. When installed, the capacity will be 6,000 kw. Three new diesel-electric units have been installed at Namtu with total of 1,200 kw. as standby units.

There is a series of seven falls with a total drop of 216 feet on the Nam Yao River. The lower six with a head of 112 feet serves the Mansam plant. There is not sufficient water in the river during the dry season to warrant the installation of additional generators with a capacity greater than 10,000-12,000 kw.

Additional power could probably be developed on the Shweli River some 35-40 miles to the north, but the cost of the transmission line over mountainous terrain makes the proposal uneconomical at the Bawdwin mine.

f. Burma Corporation Railroad. The railroad runs from the Bawdwin Mine to Namtu and from there on to Namyao at which point it meets the Burma Railways and from which point the distance is 547½ miles to Rangoon.

The Burma Corporation railroad is 45 miles long, 24-inch gauge. It crosses the Namtu River at Namtu, 33 miles from Namyao, and from near Namtu ascends the gorge of the Nam Pangyun to Tiger Camp, and switchbacks on to Bawdwin, a distance of about 12 miles, more by actual trackage.

g. Economics. Records indicate that on July 1, 1939, the reserves in the Bawdwin Mine were 3,607,945 long tons of ore. Up to that date 7,668,222 tons had been extracted. The reserves contained 17.7 oz. Ag per ton, 23.0% Pb, 13.8% Zn, 0.92% Cu. By January 1, 1941, they had declined to 3,165,745 tons containing 15.9 oz. Ag, 20.8% Pb, 12.7% Zn, and 0.92% Cu. For the year ending June 30, 1939, the mine output was 485,115 long tons of ore. The following table gives the refined products obtained from the concentrating and smelting of the ore for that year:

Refined lead (tons)	76,950
Refined silver (ounces)	6,230,000
Zinc concentrate (tons)	61,070
Copper matte (tons)	7,800
(content per ton, 42.60% Cu., 27.45% Pb., 65.46 ozs. Ag.)	
Nickel speiss (tons)	3,270
(content per ton, 31.20% Ni., 9.39% Cu., 6.60% Co., 15.70 ozs. Ag.)	
Antimonial lead (tons)	1,180
(content per ton, 74.50% Pb., 23.10% Sb., 2.74 ozs. Ag.)	

(Source: Clegg, Prof. Paper No. 13 — G.S.I.)

Prior to the war, 60% of about 3,000 workers employed underground at Bawdwin were Gurkhas, the balance Yunanese and Sino-Shans. At Namtu, where the Corporation has its main office and shops and where hospital, recreational and other community facilities are provided, Burmans and Shans were an insignificant proportion of the working force, Indian labor being predominant.

With the present immigration restrictions in Burma, mining operations on a large scale, both underground and on the surface, are going to be seriously handicapped. For such operations as Bawdwin, Namtu and Mawchi, trained and experienced labor is a prerequisite. Outside labor of this class must be imported and used until Burman, Shan and other indigenous labor is trained for the work in hand. Otherwise, the economy of Burma will suffer.

An important fact to remember is that the presently known Bawdwin ore bodies are now fully developed. Operations henceforth can recover only the known reserves. In the past, work could be concentrated on the extraction of a large and very rich ore body. Now the years of life remaining depend upon the rate of annual extraction.

After full rehabilitation of the mine, the problem before the management is exploration for new ore bodies. The depth is set by the contact of the tuff with the underlying sediments. Efforts have been made to extend the ore bodies horizontally and laterally. So far the Bawdwin large ore body appears to be definitely outlined. Drilling should be conducted along the shear of the main fault so as to explore all paralleling and subsidiary faults. Drilling should also delineate both size and shape of the tuff rock where covered by the overlying Pangyun sedi-

ments. The tuff is the only known host-rock of the ore. However, in other places there may have been mineralization in some other character of rock. So exploration should include all types of rock formations. The fact that so many old slag dumps are found scattered over the hills may indicate that other ore bodies, rich in silver and lead, may be found. With extensive granite intrusions in the area, and profound faulting, and probably accompanying fissuring and fracturing, there is every reason to believe that additional areas of mineralization exist and can be discovered.

2. THE MAWCHI MINES, LIMITED.

a. General. In the Kayah (Karreni) State of Bawlake, the tin and tungsten ores exploited by The Mawchi Mines, Limited, occur in quartz veins in the contact zone between a granite boss and the sedimentary rocks which it has intruded. The granite is in contact with limestones generally on the northeast and with sandstones and shales elsewhere. Various degrees of metamorphism of the sedimentary rocks are apparent adjacent to the contact.

There is a close relationship between the character of the mineralization of the Mawchi veins and their physical situation with respect to the contact of the granite with the surrounding sedimentary rocks. While this relationship is by no means fully known nor has the available data been satisfactorily interpreted in all respects, it has nevertheless proved distinctly helpful in developing the potentialities of the Mawchi occurrences. It is discussed here primarily because of the belief that it should prove useful in exploring the possible existence of other tin-tungsten vein deposits of similar import to the economic welfare of Burma.

b. The Ore Deposits. At Mawchi, there are between 60 and 70 recognized veins ranging from narrow stringers to veins over 10 feet in thickness. Most of them have been explored or exploited, some, in the latter instance, to near exhaustion. The veins are generally parallel in the granite; they dip steeply and strike in a northerly direction approximately normal to the longer axis of the upper portion of the granite boss. Where the veins penetrate into limestone, generally there is little if any change in strike or dip, but widths tend to decrease; the tin and tungsten tenor decreases even more rapidly and seldom persists far from the contact. In contrast, where the veins penetrate from the granite into the weaker sandstones and shades, they generally split off into numerous fissures and fractures and exhibit considerable variations of strike and dip and accompanying reductions of widths. Cassiterite and wolframite mineralization perists at greater distances from the contact, however, than it does in the limestone.

The first authentic account of the existence of tin ores at Mawchi was given by O'Riley in 1862. Remnants of slag have been found which indicate that tin ores were smelted in the immediate vicinity of the mines for many years, possibly centuries before that date. Nevertheless, Mawchi first became well known as a producer of tungsten during the 1914-1918 World War period, and has continued to be so noted despite its comparative importance, also, as a tin producer. The reason for this becomes evident in the following paragraphs.

Erosion left on steep hillsides prominent quartz outcrops of some of the more important veins. It was these comparatively accessible outcrops and their closely adjacent eluvials and alluvials that were exploited in ancient times and also in the early days of foreign exploitation. Generally, the upper horizons of the outcrops are relatively close to the northerly granite-limestone contact. No estimate has been made of the amount of vein material removed by erosion from what were the southerly extensions of some of the veins, but it must have comprised a large proportion of their richest portions. Finely divided alluvial tin occurs along the Kemapyu Chaung, and in the flats at its confluence with the Salween River more than fourteen miles distant. During erosion the wolframite, a proportionately larger constitutent of the vein material than cassiterite near the pre-erosion contacts, was rapidly comminuated to sizes so fine that a large portion was lost.

Generally, the tungsten content of the veins close to the contact is much higher than that of the tin. Near the granite contact with the limestone, a comparatively small amount of scheelite occurs with the cassiterite and wolframite; small amount at the contact of granite with less-calcareous sediments. Early mining of the quartz veins produced concentrates containing in the neighborhood of 75-80 per cent WO_3 and 25-20 per cent SnO_2. Later, as mining progressed downward from the contact, the proportion of WO_3 dropped. In 1939 it was 59% WO_3 and 41% Sn. By 1941, the year prior to the forced cessation of operations, the proportion was 44% WO_3 and 56% SnO_2 Sampling results in the lower levels indicate that future production will show a steadily decreasing proportion of WO_3. The fact is established that as depth is attained in the granite the WO_3-SnO_2 ratio gradually decreases until the WO_3 content disappears. SnO_2 values also become progressively lower and subsequently disappear even though the quartz veins themselves may remain as strong and well defined as ever.

The economically important mineralization characteristics of the Mawchi veins can be summarized, then, as follows: The 60 to 70 known veins occur generally parallel to each other and normal to the east-west axis of the uppermost portion of the intrusive granite boss. They contain their highest combined SnO_2 and WO_3 content at and adjacent to the contact of the granite with the sediments. Here, also, the WO_3 content is much higher than the SnO_2 content. As the veins continue into the granite,

not only does this ratio drop along both axes of the upper portion of the boss, but also the combined SnO_2-WO_3 content drops until it falls below the limit of payability and, further, until first the WO_3 and then the SnO_2 disappear completely.

In other words, as indicated by mining operations and development results, above the lowest horizon so far explored, there is in the granite boss a central semi-ellipsoidal portion where the quartz veins, though still strong and persistent in character, no longer contain tin and tungsten. Mineralization is found only near the contact, in both the altered sediments and granite. On the southerly side of the boss, much of the pre-erosion contact zone has been removed. The bulk of the ore that was left for exploitation was found on the vein extensions on the northerly and westerly sides of the granite boss.

On the easterly portion of the boss, beyond the area containing payable veins, the overlying sediments have been completely removed for a considerable distance, and erosion has reduced the granite itself to horizons generally well below the contact zone. Here, the granite has been subjected to intensive alteration and kaolinization has taken place to a considerable depth. It weathers easily into disintegrated material from which very small-sized segregations of cassiterite and wolframite can be washed, probably on a large-scale commercial basis, given present metal prices.

The exposures of granite at Mawchi, and particularly the altered eastern phases, constitute a topographic feature which would be of assistance in search for similar ore occurrences. Likewise, the metamorphism exhibited in the slates, quartzites and marble which constitute the sediments surrounding the granite should furnish a useful exploration guide. The utility of these superficial features in any mineral exploration program incorporating aerial reconnaissance, survey and mapping should be evaluated.

c. Economic Importance. In 1939, Mawchi produced 5,564 long tons of mixed tin and tungsten concentrates. This was approximately 36% of the total production exported from Burma for that year. In 1940 and 1941 production increased to around 6,000 tons of mixed concentrates per year and constituted an increased percentage of Burma's production of these minerals. At London quotations on January 2, 1952, the value of the contained tin and tungstic oxide would be much greater, approximately Rs. 8,24,61,138.

d. Present Status. Following the liberation of Burma, the Mawchi Mines were rehabilitated. However, the resumption of production had not progressed far until it was interrupted by the insurrection of 1949. The mine has since remained inoperative in insurgent held territory. Likewise remaining generally inaccessible are those areas to the north and south which appear to offer the most attractive possibilities for the discovery and development of ore deposits of comparable economic importance.

3. OTHER MINING OPERATIONS. Aside from the Bawdwin and Mawchi projects, already described, there are other mining operations either active or inactive at the present time. In the Taunggyi District, two mines are producing lead regularly, (R. M. Aldworth and U Sit Han). There are a few smaller operations. A hard surfaced road to Heho makes it possible for these mines to operate all year.

Aldworth is also mining zinc from the Shwedaung or Lough Keng Mine 35 miles by trail south of Mong Pawn. Seven hundred mules are now being used in the transport and shortly there will be 1,700, at which time about 30 tons per day can be shipped. In the rainy season the work must be curtailed unless an all-weather road is constructed and transport is by truck rather than by muleback.

Antimony is mined at Mong Sang and Nan Hok some 130 miles northeast of Taunggyi to which the ore is now being hauled at the rate of about 100 tons per month from each mine. The rainy season will curtail this movement as part of the distance is over unimproved roads and the transport is by mule-back and cart for these stretches. If an examination of the several mines in this area indicates sufficient ore reserves, recommendation for road improvement will be made.

The antimony mines at Lebyin are operating and the ore brought to the railroad, a distance of only one to three miles. Not much road improvement would be required to increase the production of these properties.

The Thabawleik Tin Dredging is operating at this time, a day's journey east of Mergui. Their shipments to Mergui come a large part of the way down the Great Tanasserim River.

There are a number of companies that have operated in the Mergui and Tavoy districts. On account of political conditions the legitimate industry is practically shut down. Among the well-organized and full-financed companies are: Tavoy Tin Dredging Co. Ltd., Henize Burma Tin Synd., Ltd., Kanbauk Mines, Ltd., Consolidated Tin Mines of Burma, Anglo-Burma Tin Co., Ltd., High Speed Steel Alloys Mining, Malayan & General Trust, Ltd., Island Tin Syndicate, and a few others.

Many small individual operators are probably mining and shipping some concentrates. This group produces about 22% of the tin mined and over 36% of the tungsten.

The Thayetmyo Cement plant requires both limestone and agrillaceous rock. When the plant is in operation the mining of the raw materials must be carried on.

There are probably other mining operations now going on in Burma but they are mostly of a local character.

D. AREAL DEVELOPMENT PROJECTS

1. SOUTHERN SHAN STATES. Attached is a map of part of the Southern Shan States to which reference is made elsewhere in this report. The area shown extends north from Lat. 19°00′ to 21°35′; and east from Long. 96°00′ to 98°45′. This particular area has been chosen as a "Development Project" because of the many mineral occurrences reported, the several notable deposits now being developed and others for which development is being planned.

This large area and parts adjacent may be considered a mineral province. It contains occurrences and commercial deposits of which the more important are antimony, barites, coal, lead-silver, manganese, tin-tungsten, and zinc. Of lesser economic value, but important as mineralization indicators, are arsenic, beryl, copper, gem tourmaline, gold, iron, monazite sand, ochre, molybdenum, phosphate (cave guano), salt and saltpeter, and soda soap-stone.

Exploration and development efforts should be concentrated principally on the lead and zinc, and to a lesser extent on manganese and barites. The first three are exportable minerals; the barites would supply a domestic market. Investigations should be extended to the coal occurrences with the object of finding an economically exploitable source of coking coal. Except for coking coal, all the domestic needs of Burma can be supplied from the Kalewa field. Hence, no extensive deposit need be developed in the Shan States. A deposit capable of providing 25,000 to 30,000 tons of coke a year for industry would be of great value to the economy of Burma.

Under B-4, "Economic Geology-Coal", a list of known coal occurrences is given which includes those in the Southern Shan States. Of the latter, the best known is the Loi An, a few miles east of Kalaw. Tests show that this coal has coking qualities. Efforts to mine the deposit some 30 years ago were unsuccessful due to high mining costs. The results at that time should not be considered conclusive.

The Mawson and adjacent lead areas are considered of top importance. A brief statement on this area was made under "Economic Geology". A fuller discussion of the occurrences and economic potential is added here.

Centering on the active mining now going on about 1½ to 2 miles south of the village of Bawdwin (Mawson), there is a lead carbonate zone that extends for a known five miles and probably up to seven miles. The trend is nearly north and south. The workings on the ore zone follow a series of knobs or knolls 80 to 100 feet above the intervening low areas. The lead ore is found in parallel veins and cross-stringers in a fracture or shear zone 150-250 feet wide. The veins range in thickness from very narrow up to probably little more than eight inches although a fifteen inch vein was seen in one place.

The surface is weathered to a depth of 30 to 60 feet or more and is predominantly clays and shales. Originally the rock was limestone, but it is now highly altered except for occasional masses of the original rock. The ore is cerussite, lead carbonate, down to 30-60 feet where anglesite, lead sulphate, appears. At deeper levels in or near the limestone galena, lead sulphide, is found. Not many workings in this particular area have reached the sulphide ore.

Mining is done by contract at Rs. 2 per cwt. No uniform program of exploitation is followed. Shafts 30-40 feet in depth are sunk and from them crosscuts and drifts are run. Little horizontal advance is made, however, as a minimum of timber is put in to support the roof and walls. The miners evidently believe it more expedient to pull out and open a new shaft and workings.

Adits are also driven into the sides of the hill for distances up to 100 feet without timbering to any extent, if at all. These entries are generally at right angles to the strike of the ore zone, and in such a distance several ore stringers may be cut. Drifting is done on each to a safe distance only. No explosives are used. Where limestone is met in underground driving, the heading is abandoned as the rock is too hard to mine without explosives.

From the examination made by the Consultants, it appeared that there may be an average of about six inches of ore for each 40 feet across the ore zone. With ore 40% lead, the overall grade for the mass of the entire width of the ore zone would be very small, probably about 0.5% Pb. That would be 11.2 lbs. of lead per long ton of the mass of weathered material that lies within the ore zone.

No thought of large strip-mining operations can be entertained until laboratory and pilot mill tests have been made to determine whether or not the lead-carbonate ore is amenable to wet gravity concentration methods. Tests have been made on small samples with some success.

If a large-scale stripping operation were to be undertaken, the veins should first be exposed by a machine-excavated trench normal to the strike of the ore zone. This would expose all the veins. As stripping operations advanced, selective shovel mining would follow the veins to the north and to the south. If 2,500 yards of rock from the ore zone were moved daily plus 1,000 yards of waste stripping, 125 cubic yards, or about 200 tons, of ore could be selected daily as feed to the concentration plant.

Although to date mining has been confined to the upper parts of the knolls, largely because there is less

surface wash to penetrate before reaching the veins, there is reason to believe that the mineralization follows the fracture zone across the intervening low areas between the knolls. Here there would be a thicker cover to penetrate in shaft mining or to strip in any mechanized surface mining operation.

If in the five miles of known lead occurrences only one-half, or 2½ miles, should be mineralized and if the zone has an average width of 200 feet and is weathered to a depth of 50 feet, there would be about 5,000,000 cubic yards of easily-mined material or some 7,500,000 tons. If the figure of 0.5% Pb. or 11.2 lbs. per ton is accepted, the lead content is about 84,000,000 lbs.

At present the two largest operations are carried on by U Sit Han who is producing 200 to 300 tons of lead carbonate, ore per month containing 40-45% Pb; and by R. M. Aldworth, whose property adjoins Han's to the south, with a production of 300 tons or more per month (over 400 tons shipped in December 1951). Other properties in the immediate area bring the total production to about 600 tons per month regularly with a possible output of 1,000 tons during the dry season. Between 600 and 1,000 persons are employed part time in these operations.

The gross value of 40% lead ore was Rs. 490 per ton at Rangoon in October 1951. Trucking and freight from the mine to Rangoon totaled Rs. 90. The c.i.f. London price in early January 1952 is reported to be £ 69/15 per ton of lead carbonate ore.

There are other lead mines in the Mawson area, the most prominent of which is the Bawzaing mine, about three miles southeast of the village of Mawson. When shut down in 1930 an ore reserve of 185,000 tons of 7% lead was reported. The bottom level is at 550 feet.

The shaft now being worked, the Theingon, is close by and on the 300-foot level a six-inch vein is being mined. A production of three tons of galena per day is reported.

Behre and Clegg give lists of lead properties some of which are in the area included in the "Southern Shan States Project". They will not be repeated here.

A new lead mine has recently been opened two miles west of Loi Kawng, 20°41′; 97°02′, six miles south of Taunggyi. Some 165 tons of galena have been mined. Mining is also active at Pawzaw, 21°06′; 96°33′ and at Kyaukmaung, 21°13′; 96°30′. These are not given in any other lists.

Slag from old Chinese primitive smelting operations is found all over the country, according to reports. This slag contains about 20-40% lead and is residue from operations that were carried on in ancient times for the recovery of silver.

Attention should be called to the alignment of the ore deposits and the general geology. In respect to the latter, the lead deposits appear to have favored the Ordovician limestones. No generic reason is offered. Their alignment is rather striking as is also the parallelism of the mountain ranges and valleys.

Taking the Mawson alignment as a criterion, it may be predicted that ore deposits of parallel trend will be found to the east among the Ordovician hills, if such have not already been found. Once an occurrence is found on such a trend or fracture zone, it should be followed to the north and to the south. Geologic east-west cross-sections might disclose these fracture zones.

When the "Myingyan Project" is started and if sufficient lead ore is being mined in the Southern Shan States and adjacent areas, thought may be given to the construction of a lead smelter at Myingyan. Export shipment of pig lead instead of ore would then be made and the returns realized would be much greater.

In the Mawson area, and still in association with the Ordovician limestones, barite is found in veins with the lead and also in separate veins. Under the present system of lead ore production the barite cannot be saved economically. However, if mechanical methods of stripping and open-cut mining were adopted, much of the barite could be included with the ore going to the concentrating plant and be recovered. The barite would have a near market in the oil fields.

The Lough Keng zinc mine, owned and operated by the Shwedaung Zinc Mines, is about 28 miles south of Mong Pawn. The property was roughly reconnoitered and surveyed, and the exposed deposits measured and photographed by a geologist sent by the Consultants.

The outcrops of the ore bodies are nearly solid zinc carbonate. A drill hole sunk to a depth of 20 feet is reported to have encountered the sulphide, sphalerite. Measurements of the exposed part of the ore bodies indicate a minimum of 1,000,000 tons. A shipment of 200 tons to Belgium contained 46% zinc. Shipments are now being made regularly as of January 1952 under a contract for 200 tons per month at £ 55 or Rs. 731 per ton f.o.b. Rangoon. The ore is carried by mule for some 35 miles from mine to road at a cost of Rs. 150 per ton; from there it is trucked to railhead and thence shipped to Rangoon at a cost of about Rs. 75 per ton.

One ore body is found in limestone and is evidently a replacement deposit. It lies between two parallel fracture zones that coincide with the valleys and has a cross fracture with irregular replacement of the limestone along the fracture by zinc carbonate. The general strike of the rocks and the ore body is N. 10° E., the dip being vertical. The strike of the cross-fracture and the ore body is N. 20° W.

The second ore body is massive with vertical outcrops of zinc ore up to 60 feet in height and an estimated

thickness above ground of about 100 feet. Obviously below the oxidized zone the ore body will extend to a reasonable depth as the sulphide, sphalerite. The limestone has a strike of N 10° — 15° E. and easterly dip of 11°. The walls of the ore body are nearly vertical. The ore body measures 900 feet and 615 feet across its two widest axes.

An early requirement for the effective development of this zinc deposit is an access road. From a topographic standpoint it must be built south from Mong Pawn. A survey shows that it will be 35 miles long. It must be an all-weather road built to withstand heavy traffic. Initially it could be a one-lane road with passing spots provided at frequent intervals. Later it could be widened to provide for two-way traffic. The cost of the full-width road has been estimated at about Rs. 25,000 per mile. The cost could be amortized in a short time by a small charge per ton-mile paid by the mining enterprise.

With the development of the Myingyan Project and completion of a zinc reduction plant, Lough Keng production can be shipped from Burma as zinc metal instead of ore with much greater proceeds realized from its sale.

The Ho Pong manganese deposit is located about five miles south of Ho Pong village and at 20°44′; 97°15. The ore body is exposed for 200 feet on the strike and 99 feet laterally of which 51 feet is manganese ore. Apparently there are two main north-south fractures, nearly vertical, with a minor fracture between. Part of the ore exposed is clean, hard pyrolusite with an analysis of 56.11% Mn., 1.20% Fe_2O_3, and insoluble 1.84%. Much of the exposure, however, is lower in manganese and higher in iron.

About 3,000 tons were mined by the Japanese during the war, but not shipped.

The deposit warrants a thorough study as manganese of good grade is an exportable product with a ready market.

One of the important minerals in the area is stibnite, an ore of antimony. The best known deposit is at Lebyin, close to the railroad, some 20 miles west of Kalaw. A further study of the ore area is recommended as the antimony occurrence is so promising that it may be chosen as the site of a "demonstration mine". (See Antimony Project).

The Ping Chit antimony deposit is on the south side of Taunggyi mineral area. Recommendations have been made for the construction of a cart road to a point close to the mine in order to take out the float ore that is presently available.

To the northeast, well outside the Taunggyi area, there are several promising antimony deposits. The Mong Sang and the Nan Hok, deposits near Nam Nawng which is about 100 miles from Taunggyi, are now producing at a rate of about 100 tons each per month. The grade is around 60%. The ore is brought to Taunggyi from Mong Sang mine by mule eight miles, thence across a ferry and for twelve miles by oxcart to where it is picked up by truck and hauled to Taunggyi and on to railroad at Swenyaung. Total transportation cost from mine to Rangoon is Rs. 425.

An access road is needed in these developments for a distance of 20 miles and some repairs on part of the main highway. If after an examination of these mines the apparent antimony reserves warrant such an expenditure, recommendations will be made to that effect.

It may be found expedient to build an antimony oxide plant near railhead to treat the Mong Saung and adjacent mine ores, or a larger plant to take care of the production from these sources as well as Lebyin. With the above mentioned access road built, the cost of transporting the ore from the Mong Sang mine would be reduced by more than Rs. 100 per ton. If the ore is reduced to the oxide near Taunggyi, the freight charge to Rangoon would be considerably reduced.

The recommendation is made that a resident field engineer be located at Taunggyi or Kalaw. This engineer could examine and report on mineral properties, advise as to methods of mining, make recommendations for the construction of access roads, supervise the installation of an antimony oxide plant, and render general consulting service to the individual mine operator on production problems, types of modern equipment which should be installed, and its efficient use. The economy of Burma would be benefited by adoption of such a personal-service program.

It is the consensus of the Consultants that the mineral potential of the Southern Shan States and adjacent areas has been explored to only a small extent. A much more aggressive approach is consequently recommended. The Government should not only encourage exploration but should assist in ways and means outlined in another part of this report. (See UBMDC, a financing and development company).

2. TENASSERIM. Concentrated in the districts of Mergui, Tavoy and Amherst on the Tenasserim Peninsula are many deposits of tin and tungsten. Most of the operations are alluvial and eluvial although a few are lode or hard rock mines. The deposits follow a granite range that trends northward from Malaya and which has been the controlling factor in the tin and tungsten mineralization. With the geology well understood, prospecting can be limited to definite areas, both for lode and placer occurrences.

The Tenasserim area is considered as highly important in the economy of the country because it can produce a very valuable export commodity for which there is, at this time, a great demand.

The Consultants have not been able to move freely in Tenasserim and are, therefore, handicapped in making specific recommendation as to how production might be increased. A few considerations, however, can be presented.

There are a number of large operations that are well financed. Under normal conditions they would be shipping all the tin and tungsten concentrates that their respective properties are capable of producing. Little financial or technical aid can be extended to them, nor is it wanted.

There are, however, many small operations that are carried on in a very crude manner by individual or small unorganized groups. Lack of modern equipment, technical advice and financial facilities are great handicaps in exploiting the potentials of many of the deposits which they work. It is on such operations that attention must be focused if there is to be much of an increase in output.

Recommendation has been made for the establishment by the Government of Burma of a Mineral Development Corporation, a function of which will be to assist small operators to obtain modern equipment and to render such technical assistance as will serve the maximum recovery of the minerals.

The implementing of such a program is the basis of the Tenasserim Project. As soon as possible an engineer should be assigned to the district. He should work with the small producer, learn his requirements and problems, and recommend such aid as may be needed to increase production of tin and tungsten concentrates.

An analysis of production in the districts of Amherst, Tavoy and Mergui for the four-year period of 1936-1939 indicates that about 78% of tin and 64% of wolfram concentrates were produced by organized groups or companies; about 22% and 36% respectively came from individual operations. It is the latter group that need aid in acquiring modern equipment and in technical advice to increase their production of tin and wolfram.

3. OTHER AREAS. First among the other areas to be studied is the eastern Kachin State. Here there is a complex of early crystalline rocks with granite intrusives, and sediments of the Plateau limestone series.

In the central part of the Kachin State, west of Myitkyina, both granite and ultra-basic rocks intrude into the sediments, thus providing conditions suitable for ore deposits of many different kinds of metal content.

The Consultants have had no opportunity to conduct field studies in this area but enough is known of its mineralization to warrant a recommendation that a field man be assigned to study those localities where the geologic indications are most favorable for the occurrence of mineral deposits.

As described under "General Geology, A-4", definite tectonic lines extend north and south across Burma. A line of structural disturbance passes through each of these Kachin areas. Since practically all of the ore deposits of Burma are found in intimate relation with the tectonic lines and their accompanying structural and intrusive phenomena, prospecting efforts should take into account the aid which an understanding of these relationships can provide. (see map under "Lead".)

E. ANTIMONY PROJECT.

1. SUMMARY.

a. Objectives. The first objective of the project is the achievement of an annual export of approximately 1,260 tons of refined antimony metal and 3,600 tons of 50%-grade ore. The gross return from the export of such tonnages, using October 1951 prices, is estimated at Rs. 1,13,54,580.

The ultimate objective is the export as refined metal of all the antimony which may be produced in Burma. Considering the above tonnages only, this would increase the estimated realization of foreign exchange by about Rs. 25,85,520 to a total of Rs. 1,39,40,100.

Attainment of the first objective is designed for execution in two stages. They are summarized hereinafter, together with estimated capital costs, operating costs and profits.

Excluded is the cost of a training program for mine labor and supervisory personnel and the item of operating capital. Apart from these two items, the capital cost of the two stages should not exceed Rs. 60,00,000; the annual operating profit on completion of the second stage is estimated at Rs. 61,74,000.

Following these estimates is a statement of considerations upon which achievement of the ultimate objective depends, basic price data, the time elements involved and action recommendations.

The proposed Union of Burma Mineral Development Corporation (UBMDC) would be responsible for the execution of the project.

b. First Stage. This would comprise (1) the collection at the site of a central plant of 4,000 tons of 20% ore purchased from various mines; (2) the purchase for export of shipping grade ores; (3) the development of a "demonstration" mine to produce not less than 6 tons daily of 20% ore and 2.4 tons of 50% ore; and (4) the construction of a central oxidation and reduction plant as soon as 4,000 tons of 20% ore became assured.

(1) Capital Cost. The cost of completing this stage is estimated at Rs. 9,08,951 ($81,338 plus Rs. 5,22,596). Of this total, development of the demonstration mine, with plant and equipment, accounts for Rs. 3,46,934 ($22,723 plus Rs. 2,39,000). The central plant accounts for the balance, Rs. 5,62,017 ($58,615 plus Rs. 2,83,596). Operating capital required for the purchase of 4,000

tons of 20% ore would be not less than Rs. 12,00,000; the additional operating capital required for the 50% ore would depend upon the tonnages purchased and exported and the realization periods entailed.

(2) Operating Costs and Profits. On a daily basis the expense of operating the demonstration mine is estimated at Rs. 1,991, the return from the sales of production at Rs. 4,596, the balance of profit at Rs. 2,605. The annual profit based on 250 days of operation is estimated at Rs. 6,51,250.

Similarly, the daily expense of operating the central plant is estimated at Rs. 2,922, the returns at Rs. 4,337, daily profit at Rs. 1,415 and annual profit at Rs. 3,53,750.

The annual profit from the sale of 600 tons of shipping-grade ore, at Rs. 100 per ton, would be Rs. 60,000.

The total annual profit for the first stage would thus be Rs. 10,65,000.

c. Second Stage. On completion of the first stage, five additional mines would be selected for the development of production on no lesser scale than that of the demonstration mine. An oxidation plant would be installed at each of the six mines. The reduction capacity of the central plant would be increased accordingly.

(1) Capital Cost. The capital cost of completing the second stage is estimated at Rs. 50,94,226 ($359,320 plus Rs. 33,87,456). Of this total Rs. 2,61,901 ($32,476 plus Rs. 1,07,640) will be required by the central plant; the balance of Rs. 48,32,325 ($326,844 plus Rs. 32,79,816) will be expended on mine development and plant.

(2) Operating Costs and Profits. At each mine the daily operating expense is estimated at Rs. 2,454; the returns at Rs. 5,536; and the profits at Rs. 3,082. The annual profit for the operator of each mine would be Rs. 7,70,500 on a 250-day basis.

The daily cost of central plant operation is estimated at Rs. 21,228, the returns at Rs. 25,992 and the profit at Rs. 4,764. On a 250-day basis, annual profit would be Rs. 11,91,000.

Annual profit from the purchase and export of 3,600 tons of 50% ore, at Rs. 100 per ton, would be Rs. 3,60,000.

d. Attainment of Ultimate Objective. In planning the two stages required for the first project objective, it has not appeared advisable to include at this time the additional plant installations which would be required for the reduction of high-grade shipping ores to refined metal. Detailed studies are essential to determine when such installations could be incorporated most advantageously in the central plant. Important factors bearing upon this determination will be anticipated metal prices, metal demand and the supply of highgrade ore which can be assured to the central plant.

e. Metal Price Basis of Estimate. The F.O.B. Rangoon prices for ores and metals used in the estimates were based on London prices current in October, 1951. The price of 99.6% antimony metal was taken at Rs. 5,163 per ton; of 50% antimony ore, at Rs. 1,347 per ton.

f. Time Schedule. The first stage would begin immediately with the collection of ore, the design and specification of the central plant and the development of the demonstration mine. Full operation should be attained in about two years. During this period, detailed plans would be completed for the second stage. Their execution would be initiated by the end of the period. Also completed would be the studies contemplated in "d" above. The ultimate objective should be achieved by 1960.

g. Recommendations. Prompt approval for the undertaking and execution of the antimony project by the UBMDC is recommended, with earliest initiation of the following preliminary steps:

(1) Purchase and collection of 20% grade ore at Rs. 300 per ton with Rs. 150 per ton advanced on receipt of the ore and the balance payable on assay returns.

(2) Purchase and collection of 50% ore on a similar basis at Rs. 1,200 per ton F.O.B. Rangoon.

2. MARKET OUTLOOK. World consumption of antimony has increased from around 20,000 to nearly 50,000 tons per year since 1930. The market price, down to 8 cents per pound in the '30's rose to over 18 cents in the early '40's, was 33 cents in '47 and 38 cents in '48. The New York price on January 5, 1952 was 52 cents per pound. United Kingdom prices are consistently higher. South Africa, Bolivia and Mexico are important producers. The U. S. is the largest consumer. Antimony is a scarce, strategic metal. The world market was dominated by Chinese production until war and revolution upset that country. If these conditions should change, Chinese exports will again become an important factor and will tend to depress the market. However, it seems likely that social changes in China will make it more costly than before to produce. Meantime, if a well-organized, modernized antimony industry is established in Burma, this country may be able to compete in the world market with an advantage, or at least on equality, with China.

3. PREVIOUS WORK. Before September 1951 a project was under way, initiated by Dr. Ghosh (Director of Metallurgical Research, Ministry of National Planning) to set up a treatment plant for the lowgrade ores which are now discarded in the process of sorting out shipping ore of 50% grade. Dr. Ghosh set up a small pilot plant including a Herrenschmidt type oxidation-roasting furnace and a reduction furnace. He treated sample lots of a ton or more of low-grade ore, producing oxide and then high-grade "star" metal.

4. EVALUATION OF MINES AND PROSPECTS. Information that has been assembled on antimony deposits throughout the country is presented in this report under "Economic Geology, Metallic Minerals". Six of the twenty known deposits were examined. Two of these were negative (Telegaung and Natsan); two are quite small (Pan Koi and Ho Pong); one shows promise but no vein is exposed (Ping Chit); another is in active production and likely to become a larger producer (Lebyin). Reports indicate that the Thabyu mine, near the Siamese border in Amherst, has been a large producer and has great promise of future tonnage. In conjunction with the adjoining Saw Lin Lee and Lahmpa Mines, the Thabyu area may be one of importance. The Kadiak Mine, near Thaton, is described as a "very-large, low-grade deposit, six miles long". Unfortunately, it was not possible to visit this mine because of security reasons. It has a history of production, however, and there seems little doubt that it will prove to be an important source of ore. The Paungsein Mine, near Amherst, likewise is favorably reported, but it was not possible to examine it.

Of the twenty known mines and prospects only five or six are active. All are worked by "tributors" by means of small open pits on the vein outcrops or in the loose rock eroded and transported from the outcrops. Rock is broken by hand tools, no drills nor explosives being used. From the broken rock high-grade stibnite ore is cobbed, sorted, bagged and shipped to buyers in Rangoon. The current price ranges from Rs. 1,100 to Rs. 1,200 per ton for 50% grade to Rs. 800 to 40% grade. The ore is usually carried by men to a central point where it is collected and shipped first by oxcart and then by rail or river boat. There is nothing remotely resembling modern mining practice nor have the operators any considerable knowledge of such practice. Many of the owners have never actually been on their properties.

Altogether, it seems probable that the production which can be developed from each of some six deposits may prove large enough to warrant the installation at each property of an oxidation plant of six tons daily capacity, such as Dr. Ghosh has designed. The oxide production from these mines, plus shipping-grade ore produced at the same time, should provide for the export annually of about 3,000 tons of antimony in the form of refined metal and ores.

5. PROJECT OBJECTIVES. The first objective of the project is the annual export of approximately 1,260 tons of refined antimony and 3,600 tons of 50% antimony ore. The ultimate objective is the export, in the form of refined metal, of all the antimony which Burma can produce. It would be proposed to execute in two stages the measures designed to achieve the first objective. They are set forth hereinafter, together with estimates of capital costs and operating costs and profits.

Attainment of the ultimate objective is dependent upon the conclusions and recommendations resulting from further detailed study of relevant factors which are discussed under a subsequent heading.

6. TRAINING PROGRAM. Essential to the efficient execution of the two stages required for realization of the first project objective are suitably experienced supervision and labor, both in the mines and in the treatment plants. It is particularly necessary in the mines in the early days of their development to the desired production level. Such supervision and labor is not generally available in Burma at this time, hence, an adequate training program must be undertaken if the Burmese people themselves are to enjoy the maximum advantages obtainable from the realization of the project.

Provision for such a program should be implemented as early as possible in the first stage. Thereafter, the program should be continued until a sufficient supply of competent supervisory personnel and trained labor is assured.

The estimates given do not include the cost of a training program, nor the cost of supplying trained foreign technical personnel until such time as sufficient Burmese nationalists can be supplied to serve the project's needs.

In addition to training men for responsible supervisory positions such as mine foremen and shift bosses, it will also be necessary to convince mine owners and operators of the advantages to be derived from the suitable development and mechanization of their surface and underground operations. While it may be comparatively easy to demonstrate that the development and extraction of ore at depth will be more profitable than mining from scattered open pits on the upper ten feet of vein outcrops, it will take time and effort to train men to use compressed air rock drills effectively, to set timber supports properly and to perform other underground operations efficiently. Similarly, but to a lesser extent, sufficient surface labor will have to be taught how to operate hoists, compressors, electrical equipment and how to run the proposed oxidation plants. The current lack of an adequate supply of trained labor is a major reason for the proposal to proceed by stages towards the accomplishment of the first objective.

7. EXECUTION OF THE PROJECT. The proposed Union of Burma Mineral Development Corporation (UBMDC) would be the entity best qualified to undertake the execution of the antimony project. Through it the necessary capital could be made available. It could most logically secure such technical personnel and administrative services as would be required for earliest initiation and expedition of the project until such time as qualified Burmese replacements could be trained.

8. THE FIRST STAGE. This would comprise (1) the collection at the site of a central plant of 4,000 tons of 20% ore purchased from various mines; (2) the purchase for export of shipping grade ores; (3) the development of a "demonstration" mine to produce not less than 6 tons daily of 20% ore and at the same time 2.4 tons of 50% ore; and (4) the construction of a central oxidation and reduction plant as soon as 4,000 tons of 20% ore is assured.

The central plant would consist of one oxidation plant of six tons daily capacity and a small reduction unit constructed at some site in or adjacent to Rangoon. Here the 20% ore would be roasted to produce 70% antimony oxide. The oxide would be converted to metal in the small reverboratory furnace of the reduction unit.

This antimony metal and the 50% shipping-grade ore would be exported.

Construction of the plant should be completed within one year from the time of breaking ground and the ordering of equipment. This would be started as soon as a sufficient supply of low-grade ore became assured. All of the 4,000 tons of low-grade ore requisite to justify construction of the plant would not need to be stockpiled at the plant. Reasonable assurance of the ready availability of part of it from the mines would suffice.

9. THE SECOND STAGE. On completion of the first stage, five additional mines would be selected for the development of production on no lesser scale than that of the demonstration mine. An oxidation plant would be installed at each of the six mines. The reduction capacity of the central plant would be increased accordingly.

With six mines operating their own oxidation plants and delivering their oxide product to the central plant, the oxidation section of the central plant would then be used, primarily for the treatment of odd lots of low grade ore from mines not close to other oxidation plants. It would also treat liquation residues at such time as the installation of additional facilities might provide for the reduction to refined metal of all the shipping-grade ores purchased, this being the ultimate objective of the project.

The second stage will be progressive and will require several years for completion. Taking into account the time required for training personnel, and for securing a return to normal operating conditions, 1960 may be a reasonable date by which to anticipate full realization of the project's objectives.

10. THE CENTRAL PLANT. The oxidation roasting plant, as designed by Dr. Ghosh, is the well known Herrenschmidt process. For easier reference, the flow sheet for the first stage of the project is presented in the next pages.

In this process, broken ore is charged to a furnace where the antimony sulphide or oxide in the ore is volatilized and condensed in cooling chambers as antimony oxide. There it is collected in cloth bags through which the other gases pass, leaving the antimony oxide as a white or reddish dust. This dust, mixed with charcoal, soda ash and salt, is then charged into a small reverberatory furnace where it is reduced to antimony metal. The oxidation process is suited to ores of 10% to 30% grade. Overall recovery may exceed 80% when temperatures are well regulated. A 70% recovery is assumed in the project estimates.

At some stage in the execution of the project, if subsequent studies so indicate, it is proposed to install the additional equipment necessary for "liquating" high-grade shipping ores to obtain nearly pure sulphide in bars and, subsequently, antimony metal. Liquation consists of a reducing roast applied to high-grade antimony ore (plus 50% Sb.). The sulphide melts and is withdrawn for casting into bars. This product is called "crude" and contains around 70% antimony. The bars are then retorted with scrap iron to convert the crude to antimony metal.

These processes are all standard practice. Procedures, costs and results are known from the performance of many existing plants. This does not infer, however, that there will be no problems in their adaptation to Burma ores. For instance, feed to the oxidation furnace must be broken to 2 inches or less. Fines below ½ inch should not be charged to the furnace unless they are mixed with clay and pelletized, or unless mixed with a little cement and briquetted.

Arsenic and lead often occur in antimony ores and are an objectionable impurity in the metal. Although the ores examined appear to be free of these impurities, they doubtless occur in some instances. Repeated melting with reagents and skimming, with attendant fume losses, is necessary to eliminate them.

Although Dr. Ghosh's preliminary plans for these plants appear to be adequate, it would be proper procedure to have the final plans drawn, or at least checked, by a firm of metallurgical engineers experienced in the design and performance of similar plants. Structural steel for the plant units and buildings should be fabricated abroad, possibly in India. Many castings might be made locally, using scarp iron. Local brick would be used in the furnace units and stack except for linings of imported firebrick.

11. FLOW SHEET FOR CENTRAL PLANT, FIRST STAGE. The flow sheet for central plant, first stage appears on the following unnumbered page.

12. REDUCTION PLANT FOR HIGH-GRADE ORES. In planning the two stages required for the first project objective, it has not appeared advisable to include at this time the additional plant installations which would be required for the reduction of high-grade shipping ores to refined metal. Detailed studies are essential to deter-

mine when such installations could be incorporated most advantageously in the central plant. Important factors bearing upon this determination will be anticipated metal prices, metal demand and the supply of high-grade ore which can be assured to the central plant.

Recent consultations in the United States indicate that, providing a sufficient supply of high-grade ore to the Central Plant can be assured, the installation of equipment for its reduction to metal might be economically desirable at the inception of the project. Were this to be done, the capital expenditure required for the project would be increased in the first stage. The cost of the Central Plant would then be raised to an estimated total of Rs. 10,80,480 ($119,841 plus Rs. 5,11,236).

The additional capital outlay would be warranted if the amount of high-grade ore reasonably assured were sufficient so that the profits from its reduction to metal would liquidate the outlay. The profit from the purchase and export of 50% grade ore is estimated at Rs. 147 per ton, although in estimating operating profits a more conservative figure of Rs. 100 per ton has been used. The profit from the reduction of the ore to metal should be no less than Rs. 300 per ton of ore purchased. With the additional capital outlay estimated at Rs. 5,18,463, it appears that a minimum of 2,000 tons of high-grade ore should be assured in order to justify it.

13. THE DEMONSTRATION MINE. Information to date points to three possibilities for the development of a demonstration mine and the subsequent installation of its own oxidation plant, so far as ore deposits are concerned. These are Thabyu in Amherst, Kadaik near Thaton, and Lebyin, 20 miles west of Kalaw. Access to Thabyu is so difficult that it would not serve. Kadaik is conveniently located and would be preferred, other things being equal. However, it has not been examined, as has Lebyin. Hence, the Lebyin Mine has been taken as a base for planning.

The Lebyin Mine belongs to Daw Saw Khin, a Shan lady, widow of the former owner (see "Antimony Mines" No. 15). It is suggested that either (1) the UBMDC make a working agreement with the owner and develop the mine for its own account, or (2) that some private mine operator, such as U Sit Han of Mawson or R. M. Aldworth of Taunggyi, be persuaded to purchase or lease the mine from the owner and develop it in cooperation with UBMDC.

The first step would be the completion of a geological study and topographical survey to serve as a basis for planning mine development. Brief observations made over a small part of the mine showed a vertical vein 4′ to 8′ wide in hard quartzite, with average values of possibly 6% Sb. Assuming that half of the ore extracted will produce shipping grade and half furnace grade, 44 tons of ground would have to be broken daily to supply 6 tons of 20% furnace grade ore. At the same time 2.39 tons of 50% shipping-grade ore would be obtained. The mine would be opened by one or two crosscut adits intersecting the vein at 100 to 200 feet below the outcrop. A raise would be driven to the surface for ventilation and double escape. Drifts would be advanced along the vein, and stope raises started where the ore is payable. A gasoline driven portable compressor would be set up at the portal to serve machine rock drilling operations. About half the broken ground would probably be discarded as barren rock and left in the stope; the other half would be trammed in cars to the portal where additional sorting would reduce it to 8½ tons. It would then be trucked about two miles to the railway station for shipment to the Central Plant. The estimated cost of mine equipment and development is 3.5 lakhs of rupees.

Since the installation of an oxidation unit at the mine will cost 2.9 lakhs, and operating profit may be estimated at Rs. 50 per ton mined, not less than 6,000 tons of ore should be "blocked out" in advance of the undertaking.

The following estimates of capital cost, operating cost and profit are made on the basis of operation of the mine by private enterprise, and provide for an attractive profit margin.

14. COST ESTIMATES FOR PLANT INSTALLATIONS. The basis of the following estimates are preliminary plans by Dr. Ghosh, dated February 28, 1951. The foreign exchange required is expressed in dollars. A dollar exchange rate of Rs. 4.75 is assumed. Items of rupees following equipment costs represent installation costs.

a. Oxidation Plant. This has been designed with 6 tons daily capacity for installation at the several mines and in the central plants for oxidation and reduction, first stage. The principal items included are the furnace, condenser, multiclone, baghouse, 50-foot stack, plant buildings, ore storage facilities, office, laboratory and utilities.

	Units	*Unit Cost*	*Dollars*	*Rupees*
Steelwork, fabricated	31000 lbs.	$0.15	4650	
Steelwork, erection		Rs. 0-4		7,750
Castings	2500 lbs.	Rs. 1-0		2,500
Reinforcing steel	2000 lbs.	$0.10	200	
Fan, with electric motor & controls, 5 h.p.	1		420	400
Crusher, 7″ x 9″, with 10 h.p. motor & controls	1		2460	1,000
Diesel driven generators, 1-25 h.p.—1-5 h.p. with switchboard and including plant wiring	2		6000	3,000
Scales, ½ ton	1		100	
Cars, 1000 lb. capacity	2	$300	600	
Pipe, cast iron, 8″	100 ft.	$2.40	240	400
Track, Decauville	300 ft.	$2.00	600	500
Chain hoist, 1 ton			150	
Pipe, galv. 2″	2000 ft.	$0.30	600	400
Damper sets, coiled springs			350	
Glazed tile	300sq.ft.	$0.20	60	200
Bags for baghouse, 3 sets			1000	

	Units	*Unit Cost*	*Dollars*	*Rupees*
Concrete work	100 cy.	Rs. 100		10,000
Common brick, in place	40 M	Rs. 250		10,000
Firebrick, in place	2 M	Rs. 600		1,200
Corrugated roofing, baghouses	900sq.ft.	$0.20	180	180
Stack, brick, 50 ft. high				15,000
Housing, steel frame, corrugated sheet roof & walls	1200sq.ft.	$6.00	7200	9,000
Housing, wood frame, corrugated sheet roof	1200sq.ft.	Rs. 20		24,000
Housing, office and laboratory, brick	600sq.ft.	Rs. 25		15,000
Office and laboratory equipment			300	2,000
Freight, overseas, plus incidental expense	50 tons	$50	2500	
Transport, domestic	150tons	Rs.100		15,000
Total, not including overhead			27,610	1,17,530
Purchasing and export, 5% of foreign currency expense				
Administration, 10% of rupee expense			1,380	
Engineering for initial plant, including metallurgical and structural design, field layout, and inspection 10%			2,761	11,753
				11,753
Total			31,751	Rs. 1,41,036
Equivalent dollars	$61,443			
Equivalent Rupees	Rs. 2,91,853			

b. *Reduction Unit.* The cost of one reduction unit has been estimated as follows. Four of these units are included in the central plant, see "c" below.

	Units	*Unit Cost*	*Dollars*	*Rupees*
Reverberatory Unit for 1500 lbs. oxide feed per 24 hrs.,	3000 lbs.	$0.15	450	
Structural steelwork	1500 lbs.	Rs.1.0		1,500
Castings	12 M	Rs.250		3,000
Common brick, incl. labor & materials	2 M	Rs.600		1,200
Firebrick, incl. labor & materials				1,500
Erection, except brickwork	25 ft.	$3.60	90	
Castiron pipe, 10" connection to header	15 cy.	Rs.100		
Concrete foundation				1,500
Total, per unit			$540	8,700

c. *Complete Oxidation and Reduction Plant, First Stage.* The total cost of the central plant, first stage, has been estimated as follows:

	Dollars	*Rupees*
Oxidation Plant as in "a" above	34,751	141,036
If erected at Rangoon, deduct the item of transport of Rs. 15,000		
Cost of increasing 50 ft. stack to 100 feet		35,000
Four reverberatory units (see "b")	2,160	34,800
Housing, steel frame, additional to oxidation plant 4000 sq. ft. $5	20,000	30,000
Office and laboratory equipment	1,200	1,500
Office and laboratory, housing 1200 sq. ft. Rs. 25		30,000
Additional purchase and export expense	1,168	
Additional administrative expense		13,130
Additional engineering expense	2,336	13,130
Total, initial cost of Rangoon Plant	58,615	2,83,596
Equivalent dollars — $118,319		
Equivalent rupees — Rs. 5,62,017		

Note: Although a diesel generator will not be required as in the oxidation plant for installation at a mine, this estimated $6000 plus Rs. 3,000 is about what may be required for transmission line and step-down transformers in the central plant. Hence, no deduction is made for this item.

d. *Central Oxidation and Reduction Plant, Second Stage.* The second stage of operation will necessitate the installation of additional equipment to treat the larger tonnage of oxide produced by oxidation plants at the six mines. In addition to "c", the following items will be required:

	Units	*Unit Cost*	*Dollars*	*Rupees*
6 reverberatory units, as in "b"			3,240	52,200
Additional housing steel frame	5000 sq. ft.	$5	25,000	37,500
Purchase and export expense (5% of dollar estimate)			1,412	
Administration, 10% of rupee estimate				8,970
Engineering, 10% of totals			2,824	8,970
Total additional cost for Second Stage			32,476	1,07,640
Total, equivalent dollars — $55,137				
Total, equivalent rupees — Rs. 2,61,901				

15. PLANT DATA. The following data has been used in the foregoing estimates.

a. Recoveries have been estimated at 80% for the oxidation plant and 87.5% for the reduction plant. The overall recovery of antimony metal from 20% furnace-grade ore has been assumed at 70%.

b. The reverberatory units required for treating the oxide produced daily from 6 tons of low-grade ore fed to the oxidation section in the first stage were determined as follows:

80% recovery of Sb. content of 70% oxide gives 1.37 tons or 3069 lbs. At 1500 lbs. per 24 hours, two reverberatory units will be in continual service, with two units standing by. Thus, four are required.

c. The reverberatory units required for the production from the oxide of 1000 tons metal annually have been calculated as follows: Charge per unit, 500 lbs. of 70% oxide per unit per 8 hours; metal recovery, 87.5%; 1000 x 2240/ 500 x .70 x .875 = 7314 shifts, or 2438 reverberatory days. Thus, 10 reverberatory units are required to equip the central plant for the second stage.

16. COST ESTIMATES FOR MINE DEVELOPMENT, PLANT AND EQUIPMENT. The following estimates are based on the requirements of the Lebyin Mine. The same estimate has been used for the cost of developing and equipping the five additional mines included in the second stage.

a. Mine Plant.

	Units	*Unit Cost*	*Dollars*	*Rupees*
2 portable gasoline-driven compressors, 220 c.f.m.	2	$ 3500	7,000	
Drills: 4 jack hammers with jack legs, 4 jack hammers	8			2,480

	Units	Unit Cost	Dollars	Rupees
Single drum hoist, gasoline-driven and 500 ft. of cable	1		3,200	
Suction fan, gasoline driven	1		500	
Drill sharpener & oil furnace	1		1,200	
Pipe: 1000 ft. 2", 500 ft. 1½"			330	
Drill steel, one ton			460	
Shop facilities			500	
Truck, 1½ ton	1		4,000	
Spare parts stock			1,400	
Purchasing and export, 5%			1,053	
Ocean freight 12 tons	12 tons	$ 50	600	
Internal freight & trucking	20 tons	Rs. 100		2,000
Housing, wood frame	2000 sq. ft.	Rs. 20		40,000
Installation costs				3,000
Total, Mine Plant			$22,723	45,000

b. Mine Development. The estimates below include the cost of labor, explosives and other supplies.

	Units	Unit Cost	Dollars	Rupees
Construction of 3 miles of truck road	3	Rs. 10,000		30,000
2 crosscut adits each 300 ft. long	600 ft.	Rs. 150		90,000
Drifts, 400 ft.	400 ft.	Rs. 100		40,000
Raises, 40 ft.	400 ft.	Rs. 60		24,000
Stope preparation				10,000
Total cost of Mine Development				1,94,000

c. Mine Plant and Development.

Total of a. and b. $22,723 Rs. 2,39,000
Equivalent dollars — $73,039
Equivalent rupees — Rs. 3,46,934

d. Mine Camp and Utilities. This estimate is based upon housing a mine labor force of 100 men at one mine only, using "basha" type construction. In stage two, six such camps would be envisaged.

	Units	Unit Cost	Dollars	Rupees
Family dwellings, 1000 sq. ft. ea	20	Rs. 3000		60,000
Bachelor quarters 200 sq. ft. ea.	80	600		48,000
School 1200 sq. ft.	1	3600		3,600
Water supply				15,000
Electric wiring				5,000
Community and cinema hall				25,000
Roads and trails				10,000
Total, Mine Camp and Utilities				1,66,600

17. OPERATING COSTS AND PROFITS.

a. Mine Operation, First Stage. On the basis of the following estimates, the capital cost of mine development will be returned by less than one year's operation.

	Rupees	Unit Cost
Daily operating cost:		
Bulk mining 44 tons @ Rs. 15	Rs. 660	
Sorting, 22 tons @ Rs. 30	660	
Haulage to Railway 8.39 tons @ Rs. 20	168	
Sacks, at Rs. 3 per 100 lb. sack	188	
Supervision and Incidentals	200	
Royalty to Government 2½%	115	
Total daily operating cost	Rs. 1,991	1,991
Daily operating return:		
6 tons 20% furnace-grade, sold to UBMDC at Rs. 300	1,800	
2.39 tons of shipping-grade, sold to UBMDC at Rs. 1,170	2,796	
Total, Operating Return	4,596	4,596
Daily operating profit		Rs. 2,605

b. Central Plant Operation, First Stage.

	Unit Cost	Rupees
Daily operating cost:		
Ore purchase, 6 tons @ Rs. 300	Rs. 1,800	
Charcoal, ½ ton	50	
Coal or coke, 1½ ton	150	
Soda ash, 300 lbs.	35	
Sodium sulphide, 20 lbs.	50	
Salt, 75 lbs.	10	
Labor, 60 man shifts @ Rs. 5	300	
Power	140	
Supervision, control, admin.	200	
Contingencies, 20% of operating costs	187	
Total Daily operating cost	Rs. 2,922	Rs. 2,922
Daily operating returns:		
Yield of antimony metal, at 70% recovery—1,881.6 lbs. value at Rs. 5,163 per ton		Rs. 4,337
Daily Operating Profit		Rs. 1,415
Profit per ton of ore treated		236

For purposes of plant amortization, profits are assumed to be Rs. 150 per ton treated.

In addition to the profit resulting from the treatment of low-grade ores in the central plant, there should be a profit from the purchase and export of high-grade shipping ore. With freight at Rs. 30, the cost at Rangoon is estimated at Rs. 1,200 per ton of 50% ore. The value of this ore at Rangoon has been estimated at Rs. 1,347 per ton. This may be deemed a sufficient margin to provide for handling and for a hedge against market fluctuations. If a net profit of Rs. 100 only is figured for this ore, the daily profit from this source would be Rs. 239.

c. Mine Operation, Second Stage. In the second stage, 6 tons of low-grade ore will be produced daily and treated in the oxidation plant installed at the mine. The production and shipment of high-grade ore will be continued as in the first stage.

	Unit Cost	Rupees
Daily operating expense:		
Mining and haulage as above		Rs. 1,991
Roasting Plant operation 0.5 ton charcoal @ Rs. 100	Rs. 50	
Fuel for power plant	36	
Labor, 30 man days @ Rs. 5	150	
Supervision, administr.	150	
Contingencies, 20%	77	
	Rs. 463	Rs. 463
Total operating expense		Rs. 2,454
Daily operating returns:		
From the sale of oxide to the Central Plant, 1.370 tons @ Rs. 2,000 per ton	Rs. 2,470	
From the sale of 2.39 tons of shipping-grade ore at Rs. 1,170	2,796	
Total Operating Return	Rs. 5,536	Rs. 5,536
Daily Operating Profit		Rs. 3,082

d. Central Plant Operation, Second Stage. From each mine in operation as in "c", the central plant would purchase 1.37 tons of 70% oxide and reduce it to metal with the following estimated results:

	Unit Cost	*Rupees*
Purchase 1.37 tons of oxide at Rs. 2,000 per ton		Rs. 2,740
Reduction Plant Operation		
½ ton charcoal at 100	Rs. 50	
Coal or coke 1½ tons	150	
Soda ash 300 lbs.	35	
Sodium sulphide 20 lbs.	50	
Salt 75 lbs.	10	
Power	70	
Labor 30 man shifts @ Rs. 5	150	
Supervision, control, admin.	150	
Contingencies, 20%	133	Rs. 798
	Rs. 798	
Total Daily Expense		Rs. 3,538
Yield of Antimony Metal at 87.5% recovery, 0.839125 Ton value at Rs. 5,163		Rs. 4,332
Profit to Central Plant, daily for each mine in operation as in "c" above		Rs. 794

In addition to this will be the profit on the purchase and export of shipping-grade ore, as shown in "b", at Rs. 239 per day for each mine in operation.

18. TOTAL COST OF ANTIMONY PROJECT. With six mines in operation, assuming the same costs as those of the demonstration mine and the central plant at its second stage, the capital cost of the antimony project can be recapitulated as follows:

6 mines at $22,723 plus Rs. 2,39,000 =	$136,338	Rs. 14,34,000
6 camps at Rs. 1,66,600		9,99,600
6 oxidation plants at the mines at $31,751 plus Rs. 1,41,036	190,506	8,46,216
Central Plant, First Stage	58,615	2,83,596
Central Plant, Second Stage	32,476	1,07,640
Total	$417,935	Rs. 36,71,052

Total Equivalent Dollars — $1,190,788
Total Equivalent Rupees — Rs. 56,56,243

19. ORE AND METAL PRICES.

Quotations, London "Metal Bulletin", October 19, 1951:

Metal, 99.6% Sb. £402½ per long ton

Ore, 50 - 55% Sb. 45 to 50s. per unit of contained metal—£112 to £125 per ton of 50% ore.

Freight from Rangoon to U.K., plus insurance and handling is estimated at £10-14 per ton for ore and £14-6 for metal in bars.

Net values at Rangoon are:

Metal £388-4 - Rs. 5,163.

Ore, 50% £101-6 - Rs. 1,347.

20. RECOMMENDATIONS. It will be appreciated that the above figures on mine development, equipment and contemplated production are based on very brief field observations and that they are, therefore, quite speculative. Only one of the three mines considered important at this stage has been examined in the field. Plans provide for a thorough examination within the next few months of the Lebyin mine and others that may prove accessible. If possible, several days will be spent examining the Kadaik Mine near Thaton, since this would be preferable to Lebyin as a "demonstration mine", due to its convenient location. One of these two will be selected as a demonstration mine and detailed plans will be submitted for its development.

The assumption has been made that mining and sorting can be conducted so as to produce 50% shipping-grade and 20% furnace-grade ores. However, further studies may indicate that the high-grade ore can be eliminated and the entire product treated as furnace feed after some elimination of waste rock by hand sorting. Or, a gravity concentration plant, using jig and table concentration, may prove preferable to hand sorting. On the other hand, some deposits may prove capable of producing high-grade ore only. Such changes, however, are not likely to affect seriously the overall estimates herein presented.

Prompt approval for the undertaking and execution of the antimony project in its entirety, preferably by UBMDC, is recommended. Meanwhile, pending formal approval, an appropriate agency of Government should immediately advise all antimony producers that low-grade ore of 20% metal content will be purchased at Rs. 300 per ton, delivered at any railway station or waterways port, and that advances of Rr. 150 will be made on delivery with the balance payable on assay proof of metal content. This will at least stimulate producers to save and stockpile their low-grade rejects instead of discarding them as at present.

When the amount of ore so stockpiled, plus that blocked out and available for extraction at the demonstration mine and other mines, reaches four thousand tons the installation of the central plant is recommended.

F. KALEWA COAL PROJECT.

1. SUMMARY. Brief examination of the Kalewa Coal Field shows that the main 10-foot seam is probably continuous for a least 9,000 feet on the surface, and that other seams are likely to make, together with it, an average of 15 feet thickness of recoverable coal. Old reports indicate a continuation of the 10-foot seam for 25 miles north of the Myittha River.

The coal is a high volatile, subbituminous "A" coal. It oxidizes rapidly on exposure and partly decomposes into fines which renders it difficult to use on hand-fired grates. Although not much heating value is lost by oxidation, it becomes "dead burning" and slower to ignite. It is specially recommended for equipment designed for pulverized coal, and, when so used, a high degree of efficiency will be attainable. It is believed that this coal will serve all Burma's coal requirements, although for railroad locomotive use briquetting may prove necessary.

From information at hand, and subject to revision as investigations proceed, the cost of production at the rate of 350,000 tons annually is estimated at Rs. 20 per ton. The cost of installing plant and equipment for a capacity of 1,500 tons daily will be approximately

$2,745,000 plus Rs. 87,87,000 (equivalent dollars $4,595,000; equivalent rupees 2,18,25,750).

Transport to points of use will be by river barge. This will entail a considerable outlay for special coal barges and for power boats which may require as much as 2½ million dollars. The cost of river transport has not been accurately estimated, but it will probably not exceed Rs. 35 per ton to Rangoon, Rs. 15 to Myingyan, and Rs. 20 to Mandalay.

The overall benefit to Burma's economy, compared with importation of Indian coal, will be between 123 and 164 lakhs of rupees annually on the basis of a pre-war consumption of 350,000 tons annually. In addition, there are the advantages of an improved trade balance, increased domestic employment, and a greater degree of self-sufficiency.

Although information at hand does not warrant immediate steps toward mining, the outlook is considered sufficiently promising to justify a recommendation for immediate exploration by diamond drilling. Also recommended are plant-scale tests to determine the combustion characteristics of the coal and the type of equipment best adapted for its use, and tests of briquetting possibilities and performance of briquettes. A detailed topographical survey, geological study, personnel study, and study of water transport costs are also recommended. The total cost of such preliminary investigation will be about $200,000 and Rs. 6,35,000.

2. LOCATION. Kalewa is a village on the Chindwin River about 150 miles northwest of Mandalay. The Myittha River runs into the Chindwin from the west at Kalewa. Three miles west of Kalewa the Myittha River cuts across the upper Eocene coal measures and the overlying Pegu sandstone, making a narrow gorge through the sandstone section. The sandstone makes a prominent ridge of north-south trend. At the west foot of this ridge the coal measures outcrop in creek valleys. In aerial photographs, and viewed from a plane, the regularity and continuity of this formation are impressive.

3. PREVIOUS WORK AND REPORTS. In 1889, Noetling explored these coal measures. He reported a 10-foot coal seam in Nantahin Creek, 11 miles north of the Myittha River. Analysis of this coal was M-10.6, V-34.0, Fc-47.2, A-8.2. He noted that a 4-foot seam and other smaller seams occur in the same valley. He reported similar coal occurrences in various valleys over 60 miles from the Myittha River northward, in a band paralleling the Chindwin River and within 6 miles of it. Throughout, dips are near 45 degrees, and one thick seam predominates, he stated. Some irregularities are noted near the north end of the 60-mile strip; the best part he considered to be the 25 miles extending north from the Myittha River to Peluswa.

About 1926 to 1930, a company, organized to develop this field and called the Burma Coalfields, Limited, sank the Fairweather-Richards shaft 100 feet vertically to intersect the main seam, and drifted 100 feet north and south. This enterprise failed without having reached the stage of commercial production, presumably because the coal did not prove acceptable to consumers. There was opposition, also, from Bengal coal producers who no doubt exercised banking and other influence to prevent this competition.

In 1929, Fox studied the immediate Kalewa area and made various sections and maps of the district. Dr. Ba. Thi of the Burma Geological Survey made a detailed geological study in 1948 and attempted to correlate the seams. In 1950, U Maung Pu, Mining Adviser, made a traverse, tying in most of the outcrops. He also began a prospect shaft, planned to go down 500 feet, which at this time has reached 85 feet down the incline on the main or middle seam.

4. RECENT FIELD EXAMINATION. In November 1951 four days were spent in the field during which time all known coal exposures were examined and several previously unknown ones were located. Two typical sections across the coal measures were surveyed for the purpose of planning a drilling program, and several other sections were measured. These are shown on Sheets 1 and 2 at the end of this part of the report.

The main, or middle seam, was correlated in seven different outcrops from ordinates 1500 south to 7500 north. Five of these outcrops measured from 9 to 12 feet and averaged slightly over 10 feet in thickness. The coal is continuous from top to bottom, with no partings. Only at one place did the lower twelves inches appear to be slightly shaly and contorted. Otherwise the seam is even bedded, blocky, with bright coal and no visible impurities. The roof of the seam is gray shale, slightly sandy and moderately firm up to ten to fifteen feet over the coal where thin sandstone beds occur. The footwall is a whitish-gray shale, also firm and slightly sandy. The hangingwall—or roof—will require frequent support in mine workings. It may prove amenable to roof bolting, if this method should be desirable. Also, it may prove advisable to leave some coal on the roof contact to improve the roof support. The football shale will be firm when dry but is likely to become plastic when wet.

The correlation of the various outcrops of the main seam is readily apparent from its constant relation to a parallel sandstone bed which makes a prominent low ridge running north and south, and causes waterfalls in the creeks which cross it. It is generally about a hundred feet below the main seam. The continuity of this main seam, along its outcrop, is thus well established for about 9,000 feet. Reports of other outcrops in creeks one and

two miles north of ordinate 7,500 (Ye-e Creek), and at Nantahin River, 11 miles north, indicate the probability of unbroken continuity for many miles.

The other seams show similar evidence of continuity but are much thinner. A "lower" seam which occurs just below the sandstone referred to above is four to six feet thick but usually has two shale partings which will be difficult to separate from the coal in mining, thus requiring mechanical cleaning. One or two seams above the main seam are often, but not always, over four feet thick. Four feet is estimated as the probable lower limit of economical mining in this area.

5. GENERAL CONDITIONS RELEVANT TO EXPLOITATION.

a. Water. Openings in the main seam are unlikely to have much water, due to the impervious shale above and below. Where sandstone beds are crossed there may be a considerable flow of water, however, and it may be advisable to line such openings with cement ,or to seal them otherwise. Water stood at 35 feet in the prospect shaft at the time of examination.

b. Timber. There is abundant hardwood timber in the immediate neighborhood. Six-inch round timber costs Rs. 0/4 per foot. Sawed timber is Rs. 240 per ton (50 cubic feet), or about Rs. 0/6 per board foot.

c. Transport. The road to Kalewa from Thit Chauk (see Sheet 3) is an all-weather macadam road, about 12 feet wide, with Bailey bridges. There are no grades of importance, as it follows the Myittha River. Widening this road for heavy two-way traffic would not be expensive if the bridges remain with a single lane. The Myittha River is swift in the sandstone gorge, reaching five miles an hour in places. The dry weather minimum depth is said to be three feet. If shallow draft barges are used for coal traffic on the Chindwin, it may be possible to run them all the way up to the coal field four miles to the west.

d. Loading into Barges. The range between high and low water on the Myittha at the coal outcrop is 35 feet. It is more nearly 50 feet at Kalewa. Transfer and storage bins at either place will be above high water, and a suspended, pivoted, conveyor bridge could be used to load barges, in order to take care of the variation between high and low water.

e. Labor. Only a few score of people live within walking distance of the project. The Upper Burmans and Chins of the district are not sturdy, physically. Malaria is common. There are no experienced miners in the district and it does not seem likely these lowland farmers will prove readily adaptable to mining. Since a camp and a town will have to be built, miners would probably have to be recruited from other areas, possibly from the Chin Hills. The wage presently paid to men on coal prospecting is two rupees per day.

f. Climate. At this low elevation the climate is warm but still notably cooler than the Irrawaddy delta. Rainfall averages 67 inches yearly. The rainy season is from May to November with a long dry season between. This accounts for the great variation in river stages.

6. QUALITY OF THE COAL. Numerous tests have been made on the coal, in locomotives and barges. The results have been unfavorable with one or two exceptions. Typical of them are the two tests made this year in locomotives at the Insein yards on coal from the prospect shaft.

No. 1 Test:

> "Coal is light, has 60% dust. Steam quality, poor. Burns with a bright flame. Trial was made on grate with 1¼ inch slots. No clinker. Light ash."

No. 2 Test:

> "Trial similar to No. 1 Test, but with ¾ inch grate openings. Steam pressure dropped in spite of heavy firing. Shaking engine caused unburned coal to drop through grates. No clinker. Few lumps available. Coal was 60 to 70% dust. Brick arch in firebox was partly open. Suggest new test with coal screened over 1 inch."

In the prospect shaft, 50-pound samples were cut every ten feet and kept in sealed cans. On inspection they showed effects of weathering to about forty feet depth, but from 40 to 80 feet the samples were free of weather stains and were hard and bright. A sample taken at 80 feet depth was sent for analysis and testing to the Commercial Testing and Engineering Company of Chicago, U.S.A. Their analyses follow:

PROXIMATE ANALYSIS	*As rec'd.*	*Dry Basis*
Moisture	13.38%	—
Volatile	40.92%	47.24%
Fixed Carbon	41.78%	48.23%
Ash	3.92%	4.53%
Sulphur	0.42%	0.48%
Heating Value, Btu	11,027	12,730

ULTIMATE ANALYSIS	*As rec'd.*
Moisture	13.38%
Carbon	61.39%
Hydrogen	4.75%
Nitrogen	1.02%
Oxygen	15.12%
Sulphur	0.42%
Ash	3.92%

FUSION TEMPERATURE OF ASH (Reducing)	
Initial Deformation	2300° F
Fusion	2390° F
Fluid	2455° F

Free Swelling Index — Non-Agglomerating

Comments by Commercial Testing:

> "This coal is classified as subbituminous "A". The fact that this coal gave a non-agglomerating free swelling index means that it has absolutely no caking powers; hence, it is very easy to understand the combustion trouble that could be experienced if this coal should be mined and then allowed to oxidize and disintegrate before it could be burned

on grates. Therefore, because the coal is subbituminous in rank, it would seem wise to assume that the coal will oxidize rapidly after mining, and that this oxidation will be accompanied by considerable size degradation.

"This leads to the conclusion that the most suitable burning equipment would be those types which can burn most of the coal in suspension as pulverized fuel."

With its high volatile content, Kalewa coal is flashy and burns rapidly, with a long bright flame, wholly unlike Bengal coal, which burns slowly with a short flame and requires heavy drafts to obtain rapid combustion. It has nearly the same calorific value as Indian coal, however. Typical analysis of Bengal coal, as currently imported, is:

Moisture	6.0%
Volatile	24.0%
Fixed Carbon	54.0%
Ash	18.0%
Sulphur	2.9%
Heating Value, Btu	11,680

The ash-fusion characteristics of Indian coal are not stated, but it is known to clinker badly.

As pulverized coal, blown into combustion chambers with air, the Kalewa type of coal is an ideal fuel, and its efficiency in this application is much higher than that of low-volatile Indian coals. Its flashy burning makes for a smaller combustion chamber and its light, non-clinkering ash eliminates clogging of ash-removal chutes. For generating electric power in modern units with turbo-generators, it may yield a duty of 1.2 to 1.4 pounds of coal per kilowatt-hour. In stationary power plants, it will supplant Indian coal without difficulty when used as pulverized fuel. For railway locomotives, it is possible that the substitution of table-type grates or automatic underfeed stokers for the presently used slot-type grates, combined with careful screening of the coal shortly before use, would make it usable. Otherwise, it may be necessary to briquet the coal for railway use and for other hand-fired applications. This will be avoided, if possible, because briquetting plants are expensive, and the cost of briquetting would be about ten rupees per ton. If it should be possible to briquet it without using an extraneous binder, by a proper combination of fine grinding, heat, and pressure, briquetting might be favorably considered. It is done with some other subbituminous coals and tests should be made to investigate Kalewa coal in this respect.

In summation, Kalewa coal can be used for all Burma's coal needs. There remains to be determined the best method of using it for hand-fired units.

It is recommended that sufficiently large samples of Kalewa coal for combustion, briquetting and other methods of processing tests be obtained and sent to selected authorities for research to determine the best method for treating and of utilization where it is not practical to be burned as pulverized fuel.

A sum of $45,000 is allowed for this program including shipment of samples.

7. PROBABLE COST OF PRODUCTION.

Bases: Rate of production, 350,000 tons per year.
Capacity, 1,500 tons per day.

The 10-foot seam with its 45 degree dip offers both advantages and disadvantages compared with flat lying coals. The lower levels have to be kept free of water, and the coal has to be hoisted to the surface. On the other hand, loading into cars from the working face is by gravity since the coal, when broken from the face, drops into chutes whence it may be drawn into cars on haulage levels without using any loading apparatus.

Mining would consist essentially of the following operations:

Drilling and blasting from the face of the room, advancing up the dip. The roof, floor and walls can be squared up with pneumatic picks.

Placing timber, possibly at five-foot intervals, and movable wings to guide the coal into the center chute.

Drawing the coal into two- or three-ton cars at the foot of the chute and transporting it by electric trolley locomotive to the foot of the inclined shaft.

Hoisting the cars, four to six at a time, up the double-tracked inclined shaft or through a level haulage road and dumping them in a surge bin from which either—

trucks would be loaded for transport to Kalewa and there loaded into barges on the Chindwin River, or

barges would be loaded direct on the Myittha River.

Operating costs may be figured closely from the wage rate. Direct wages are assumed as Rs. 5 per day; plus an estimated Rs. 3 to cover social security, welfare, health insurance, and the cost of housing and community facilities over and above the rentals charged, the total would be Rs. 8 per day average for the crew. It may be assumed that labor is about 60% of the direct cost. At one ton per man per day the cost would be Rs. 13/4 per ton.

Transport to Kalewa in trucks, if this be done, will cost not more than Rs. 0/8 per ton-mile, or Rs. 1/8 per ton if the distance is assumed as three miles.

Summary of operating costs:

	Per Ton
Mining	Rs. 13/4
Truck Transport	Rs. 1/8
Administration & Engineering	Rs. 1/4
Amortization & Interest	Rs. 4/0
Total	Rs. 20/0

Amortization of and interest on the investment, calcu-

lated on 350,000 tons annually, amounts to Rs. 4/0 per ton on a 20-year basis. Administration and engineering are estimated at Rs. 1/4 per ton.

8. OPERATIONAL LAYOUT. The ash content of the coal is very low and if the coal can be mined without dilution from the hanging wall, no washing plant will be required. Because of the heavy dip angle and the friable roof, it is believed a washing plant as well as a screening plant may be required. This can be installed at a convenient point of transfer from river to railway or at the mine.

Installations at the mine will consist of a power generating plant using coal as fuel, a converter to provide direct current for locomotives, compressors, fans, warehouse and office facilities. A mine village at a favorable site near the mine must be built. There will also be a surge bin, a loading bridge and belt conveyor for loading into barges either at Kalewa or on the bank of the Myittha River at the mine.

Provision for a briquette plant at a location to be determined when the project is approved and engineering analyses have been completed, is included in the estimate.

The mine can be developed in either of two ways:

By inclined shaft in the footwall to the 400-foot level. (Sea level elevation +275.)

By tunnel driven in the rock beneath the 10-foot seam starting on the north side of Myittha River and paralleling the strike of the 10-foot seam.

If an inclined shaft is sunk, it appears that the most desirable place for this shaft would be just above the road at Thit Chauk Camp near zero ordinates.

From this inclined shaft, levels approximately 300 feet apart will be driven in the coal seam, and rooms will be driven up the pitch.

The field examination indicates that the cheapest, quickest and probably the best method would be to drive a tunnel in the rock beneath the 10-foot seam, and a parallel airway in the coal seam until the center of the mine field is reached. At this point a main ventilating system should be installed.

To open up this area it is recommended that the inclined shaft and the water level tunnel be driven simultaneously and be connected with all possible speed. Because of the friable nature of the coal, the mining would probably be done with pneumatic pick-hammers.

A mining village to accommodate 1,500 employees, with the necessary stores and public utilities could be built in the wide valley of Waya Chaung where it meets the Myittha River. The road to Kalewa should be improved for heavy two-way traffic.

Exploration, before any of the above expenditures are approved or made, will consist of diamond drill holes in rows of three each, every 2,000 feet for a distance of three miles north of the Myittha River. This will make 24 holes. However, if and when irregularities are encountered, additional holes will be drilled. These might amount to a 50% increase, making a total of 36 holes. The deepest of these will not be over 1,000 feet, and the total footage is estimated at 16,800 feet.

If the first few deep holes should result favorably and indicate general uniformity in the main seam at 1,000 feet down the dip, plant and preparations may proceed while the drilling is completed, without actual commitment on equipment purchase until a satisfactory tonnage is blocked out.

9. PROBABLE COST OF INSTALLATION. A tentative estimate of opening up and developing this property and the building of the mining plant is as follows:

	Dollars	*plus*	*Rupees*
Exploration and Research	$ 200,000	Rs.	6,35,000
Surface Plant at Mine	770,000		12,52,000
Equipment	700,000		
Development	100,000		13,40,000
Barge unloading and reloading Plant at Myingyan	150,000		3,60,000
Washing and Screening Plant, 100 tons per hou	225,000		4,00,000
Briquetting and Drying Plant, 50 tons per hour	400,000		10,00,000
Roads and Employee Housing	200,000		38,00,000
Total	$2,745,000		87,87,000
Total Equivalent U. S. Dollars of above	$4,595,000		
Total Equivalent Rupees	Rs. 2,18,25,750		

10. COAL RESERVE REQUISITE. The main seam is believed to average about 10 feet thick. The upper and lower seams will be workable in some places, where they have four feet or more of continuous coal. It is estimated that a total of 15 feet of workable coal is likely to be proved. Over a length of three miles and depth of 1,000 feet on the dip at 28 cubic feet per ton, assuming 70% recovery, this will amount to a recoverable tonnage of 6.0 million tons or 17 years of operation at 350,000 tons yearly.

11. COAL TRANSPORT. The most convenient place for transfer of coal from river to rail will be at Myingyan, near the junction of the Chindwin with the Irrawaddy. It has good rail connections from the south and east, although the Mandalay-Myingyan branch has not been restored since the war. Barge traffic down the Chindwin will necessarily be in small barges of not over 100-tons capacity whereas movement down the Iraawaddy can be in 300- to 500-ton barges. Myingyan, therefore, will be a barge transfer point. A power plant using fine coal as pulverized fuel can be built there to serve an electrolytic zinc plant and other industries. The length of a transmission line to serve Mandalay would be 55 miles. This is also a convenient point at which to deliver coal to the railway for locomotive use. Part of the fine coal

would be used in the power plant and the balance shipped to other stationary plants.

The consumers of Kalewa coal would be the railroad, power plants at Myingyan and Rangoon, and industries near those cities. Only minor amounts would be shipped to other points. River transport will be used, principally. Special barges will have to be built for coal, and possibly special power boats. The total cost of barges and tugs for movement of coal may be around 2½ million dollars. The cost of transport has been calculated from the data of recent estimates by the Inland Waterways Board. Probably 100-ton barges of 3½-foot draft would be used from Kalewa to Myingyan, and 300- to 500-ton barges of 5 foot draft for coal moved from Myingyan to Rangoon. Transport cost is reckoned as 1 anna per ton-mile from Kalewa to Myingyan, and 2/3 anna per ton-mile from Myingyan to Rangoon. According to this, the costs would be:

Kalewa-Myingyan—239 river miles at Rs. 0/1= Rs. 15 per ton

Myingyan-Rangoon—472 river miles at Rs. 0/0.66= Rs. 20 per ton

Myingyan-Mandalay—80 river miles at Rs. 0/1= Rs. 5 per ton

These costs are believed to be conservative and higher than those which might result from actual operation. They may be contrasted with 0.2 to 0.4 of a cent U. S. per ton-mile for river transport in the United States.

12. DELIVERED COST OF COAL.

a. Delivery at Myingyan. Screening and handling at Myingyan may add Rs. 5 to the Rs. 35 cost to that point. Resorting to briquetting would add about Rs. 10, making the total cost Rs. 50 per ton.

For railroad use, no difference is calculated between the delivery of Indian coal at Rangoon, an extremity of the railway system, over delivery of Kalewa coal at Myingyan, near the center of the system, but the saving over Indian coal at Rs. 90 at Rangoon is evident. Cost of coal delivered to industries at Myingyan is estimated at Rs. 40 per ton; at Mandalay. Rs. 45 per ton.

b. Delivery at Rangoon.

Cost at Kalewa	Rs. 20
Transport to Myingyan	Rs. 15
Screening at Myingyan	Rs. 5
Transport (river) to Rangoon	Rs. 20
	Rs. 60

The cost of Indian coal at Rangoon is Rs. 90 per ton. The heating values of the two coals are nearly equal (Kalewa coal, 11,027; Bangal coal, 11,680). Used as powdered fuel in stationary boilers, it is believed that Kalewa coal will show a higher efficiency than Indian coal, probably 1.2 to 1.4 lbs per kw. hr. compared with the present duty of 1.6 lbs. per kw. hr. using Indian coal. This belief is based on the combustion efficiency of a high-volatile, flashy-burning coal used in pulverized form compared with a high-ash, low-volatile coal (Bengal) used on chain-grate feeders. The Bengal coal is not suitable for use in powdered form due to its high ignition point and slow burning characteristics, although it may be used in a specially designed furnace.

13. ECONOMY OF KALEWA COAL. Assuming the 350,000 tons per year prewar consumption of Indian coal as normal, the economy of Kalewa over Indian coal is considerable. Even if the coal has to be trucked to Kalewa, and has to be briquetted for railroad use, both definite possibilities, the comparison would favor Kalewa coal, as follows:

	Indian Coal Rupee Cost	*Kalewa Coal Rupee Cost*
Railroad 180,000 *tons per year*		
Indian coal at Rs. 90 per ton.....	1,62,00,000	
Kalewa coal at Rs. 50 per ton.....		90,00,000
Other Consumers, assuming all to be at Rangoon, 170,000 *tons*		
Indian coal at Rs. 90 per ton.....	1,53,00,000	
Kalewa coal at Rs. 60 per ton.....		1,02,00,000
	3,15,00,000	1,92,00,000
	1,92,00,000	
Net saving from use of Kalewa Coal	1,23,00,000	

This figure of probable economy is calculated on a most conservative basis. If the estimate of costs for trucking, barging and briquetting prove to be too high, then costs may be Rs. 37 and Rs. 50 per ton at Myingyan and Rangoon, respectively, rather than Rs. 50 and Rs. 60. This would increase the difference to Rs. 1,63,40,000. The probability ranges between these two figures.

14. CONCLUSIONS AND RECOMMENDATIONS. It should be appreciated that the foregoing estimates of development and production costs are based on meager information and a short period of investigation. They are, therefore, subject to substantial revision as our studies proceed. They represent our best judgment at this time, and are offered in order to present a broad view of the project.

There is no doubt that so far as quality is concerned, Kalewa coal can supply Burma's requirements. Whether there is enough coal at Kalewa to develop a 350,000-ton-per-year production can only be proved by drilling, field geology, and ground surveys. Considerable research and engineering work will be required to determine within close limits the probable cost of mining, transporting and preparing the coal for use.

However, the outlook is sufficiently promising to justify prompt execution of the following intial steps in the development of production from the Kalewa field:

Exploration by drilling, including purchase of three drills and a tractor; improvement of the Thit Chauk camp; and carrying out the drilling program as shown in Sheet No. 3. This, it is estimated, will cost $155,000 plus Rs. 6,35,000, and will require about 18 months to complete after placing orders for equipment and allowing six months for delivery. If perchance the drilling and further investigations should result unfavorably, only a part of the estimate will have been expended, and the drilling equipment will be available for mining exploration in other places.

Research on briquetting, treatment and utilization, to determine the most economical method of preparing the Kalewa coal for the uses contemplated, other than as pulverized fuel. It is estimated that this will cost $45,000. It should proceed as soon as suitable samples can be obtained. They should then be forwarded to research laboratories to be selected.

Topographical survey of an area 5 miles long and ¾ mile wide (see Sheet No. 3), with 20-foot contours, and on a scale of 500 feet to one inch. An aerial photographic mosaic may be considered complementary to this survey.

Field geological mapping, and trenching of all important coal exposures.

Manpower survey to determine requirements and availability of technical, skilled and unskilled personnel, with a view to setting up a requisite training program. Health and welfare studies of the mine site and surrounding territory should be included.

Continuation of the present prospect shaft (now at 85 feet) to around 200 feet, then a short drift on the seam so as to open an experimental room or stope, to plan room width, timber spacing and to test mining methods. This work will provide coal for combustion and briquetting tests. Pending final results of these tests, it is not advisable to attempt to market the coal or to use it commercially, since ill-advised applications may result unfavorably and prejudice consumers against it, as in previous tests. Detailed study of the costs of water transport of coal and the probable outlay for special barges and power boats in co-operation with the Inland Water Transport Board.

It is not to be expected that the project will function at full scale and efficiency from the beginning. Early production is bound to be high in cost. It may take one or two years to realize a normal, smoothly-operating organization. Effective planning will anticipate this period of adjustment and reduce it to a minimum by training personnel well in advance of full scale operations. Stages of operation will be scheduled, with only a few hundred tons daily production during the period of mine development and preparation.

G. MYINGYAN PROJECT.

1. SUMMARY. The establishment of an industrial center at Myingyan becomes economically feasible and desirable if the planned development of the Kalewa coal field is accomplished. Cheap fuel and electric power could be provided at this point.

Under the "Kalewa Coal Project", it was noted that Myingyan would be a convenient place to install a coal-transfer plant and possibly a briquetting plant to prepare coal for railroad use. This site is suggested because it is located at the junction of the Chindwin with the Irrawaddy River, and has good railway connections north to Mandalay, south to Rangoon, northeast to Lashio, and southeast to the Southern Shan States. It is the logical point for delivery of coal, brought down from the Chindwin on 100-ton barges, to the railroad. Since coal barged down the Irrawaddy to Rangoon or up to Mandalay will move in 300- or 400-ton barges, it is also an economical transfer point for river-borne coal. (See map.)

Such a centrally located place should be a favorable site for industries dependent on cheap coal, or on cheap coal-generated electric power. The Mandalay District is a rich agricultural area. Food processing and other industries, presumably, could be established if cheap power were available. A 55-mile transmission line would carry the power from Myingyan to Mandalay where there should be a market for some 3,000 kilowatts.

An industry that would require considerable power is an electrolytic zinc plant. Important quantities of zinc in the form of concentrates are exported in normal times. The Burma Corporation exported around 66,000 tons per year before the war. It is now contemplated that production will be resumed at 1/3 of the prewar rate, or 22,000 tons. This concentrate contains 55% zinc. Known resources at the Bawdwin mine will sustain this production for at least 20 years. There are also important deposits of zinc ore southeast of Taunggyi which are now being explored (see "Southern Shan States Project", "Lough Keng Zinc Mines Near Mong Pawn") and which may furnish a large tonnage of zinc concentrates—perhaps as much or more than Bawdwin.

From the zinc concentrates that have been exported, the realization has been but a part of the value of its contained zinc, due to the heavy freight charges and the cost of treatment at its final destination. It it proposed, therefore, to establish a plant at Myingyan for production of refined zinc metal from the zinc concentrates, using coal-generated electric power. A plant capable of treating 100 tons of concentrates daily and producing therefrom 50 tons of zinc metal will cost around 5 million dol-

lars. Annual net income should be about $1,000,000. Power consumption of this plant would be 8,500 kilowatts and the load would be nearly constant for 24 hours daily.

The zinc concentrates contain 30% sulphur. In the process of roasting, this is driven off as sulphur dioxide gas. This is poisonous to vegetation. Sulphuric acid and sulphur dioxide can be recovered in the roasting process. Disposal of these products would be to such industries as a sulphide pulp plant and ammonium sulphate and superphosphate plants. Acid production would amount to over 75 tons daily. Recovery as elemental sulphur would be highly desirable in view of the strong world demand for it, but various processes to produce sulphur from smelter gases have not proved commercially successful. However, the sulphur gases given off in the roasting of the zinc ore must be utilized. It cannot be allowed to discharge into the air. Studies of the project will include this problem.

Another metallurgical industry that might be established at Myingyan is a lead smelter for the treatment of lead ores and concentrates from the Southern Shan States and possibly from the Kachin States. The lead smelter would not require much power but a considerable quantity of coke. Coke would have to be imported unless or until a domestic coking-coal deposit of workable size is discovered and developed. Coke could be brought up the river from Rangoon in otherwise empty coal barges that are returning from the delivery of Kalewa coal. The potential lead ore production of the Southern Shan States will probably prove to be large enough to warrant installation of a lead smelter.

The copper output of the Bawdwin mine will probably be less than a thousand tons of metal annually. This is not enough to warrant the expense of converter and electrolytic plants. The justification for such plants at Myingyan is dependent upon the discovery of additional sources of copper production.

The construction of a galvanizing plant might logically follow the establishment of a zinc refinery. For the purpose of producing galvanized sheet and corrugated roofing, black sheet would be imported. A copper sheet and wire plant would naturally follow a copper refinery.

The conjunction of cheap coal, cheap power, and convergence of river and rail routes make Myingyan a potential industrial center.

The specific location of the industrial site in the general Myingyan area will be made after consideration is given to the accessibility by rail and water, the attendant problem of river port site selection, and the river bank stability.

2. RECOMMENDATIONS. While exploration of the Kalewa coal field proceeds, detailed studies of the Myingyan site an metallurgical tests on the type of zinc concentrates which would be treated should be made.

If the Kalewa coal development should proceed as planned, the technical and economic factors involved in the construction and operation of the plants listed below should be determined more precisely:

Power Plant, of 20,000 kilowatt capacity, in four 5,000 kw. units. (This would cost about 4 million dollars.)

Zinc refinery, consisting of a roasting plant and an electrolytic refinery. Capacity would be 50 tons of refined zinc daily. (This may cost 5 million dollars.)

Total outlay for the power and the zinc reduction plants, plus a railroad extension, river-port works, and employee housing is estimated at $9,800,000 or equivalent Rs. 4,65,50,000. Annual operating profits, after deducting 10% for interest and depreciation, are estimated around $1,000,000, or 47.5 lakhs of rupees.

The above estimates do not pretend to be accurate and are based, as noted below, on average costs of other similar installations, corrected for the current price index of heavy equipment. They are accurate enough, however, to show the general economic justification of the Myingyan Project, the basis of which is cheap coal from Kalewa. The Myingyan Project in its early stages would use nearly 80,000 tons of coal annually.

Attached is a map which shows Myingyan, at the junction of the Chindwin and Irrawaddy rivers, and its relation to the Kalewa Coal Field to the north. There is also shown the Bawdwin Mine and railroad from there to Myingyan via Mandalay, or via Thazi.

The Southern Shan mineral area, including Mawson lead mines and the undeveloped Lough Keng zinc property, is shown near the railhead at Shwenyaung. From here ores or concentrates can be shipped via Thazi to Myingyan.

Myingyan is strategically located as a center of distribution of coal by railroad and by barge to all points in Burma. Likewise it could be the distributing point for the products of any industry that might be established at Myingyan.

The present town site of Myingyan and the Irrawaddy and Chindwin rivers are shown on an inch to the mile scale map attached. The area from point 02-67 eastward to point 02½-73 should be surveyed so as to determine the best location for the proposed new development. The land surface and harbor front should be examined as to location of the several industrial plants mentioned in the text. The coal plant, for screening and probably briquetting, should be on the water front. The power plant should be adjacent so as to use the powdered coal directly, with a minimum of transportation. The railroad could be extended westward from a point near 0-78. The annual rainfall at Myingyan averages 32 inches. Reports are that it is a healthy region.

3. PLANT COSTS AND OPERATING ESTIMATES. In the following pages, the installations are described and costs estimated approximately. In the operating estimates, it is assumed that the plants will operate 300 days at capacity. This stage is unlikely to be reached until after about two years of operation. The plants should operate profitably soon after they begin to function.

a. Power Plant.

Type: Pulverized coal burning turbogenerators
Units: 4-5,000 kw., total 20,000 kw.
Estimate: $4,000,000 ($200 per kilowatt).
Load: Zinc plant, 8,500 kw; 24 hrs. per day; Mandalay District, possibly 2,000 to 4,000 kw.
Cost of producing power:

Assume 60% load factor	
Operating cost per year	Rs. 10,00,000
Interest and depreciation at 10%	19,00,000
Coal, at Rs. 40 per ton, at 1.5 lb. per kw. hr.	28,15,720
Total Annual Expense	Rs. 57,15,720

Cost per kw. hr. 0.87 anna.
Coal used per year: 70,840 tons.

b. Zinc Plant.

Type: Flash roasting, solution, and electrolysis
Units:
(1) Flash roasting furnace, with Cottrell precipitator to recover zinc dust from flue gases.
(2) Leaching plant, with agitators, thickeners, and filters.
(3) Plant for purification of solutions.
(4) Electrolytic plant.
(5) Furnace for melting zinc cathodes and casting metal bars.

Capacity: 100 tons of zinc sulphide concentrates daily. If grade of concentrate averages 55% and recovery is 90%, approximately 50 tons of refined metal will be produced daily.
Estimate of Plant Cost: Basis of estimate; $100,000 per ton per day of zinc production. At 50 tons daily, cost would be $5,000,000.

(1) Operating Estimate.

Zinc concentrates will cost approximately Rs. 765 per ton, or Rs. 1,530 per ton of recovered zinc.

	Costs per Ton of Metal Produced
Purchase cost	Rs. 1,530
Operating cost, labor	64
Operating cost, power	230
Operating cost, supplies	50
Operating cost, Administraton, engineering & contingencies	56
Interest and depreciation, 10% of capital outlay; per ton at 15,000 tons per year....	158
Total cost per ton of refined metal.....	Rs. 2,088

(2) Value of refined zinc.

London Quotation, October 24, 1951, £196 per ton		
Freight, Rangoon-London Rs. 137/6		
Insurance and handling charges, approx.	Rs. 20	
Freight Myingyan — Rangoon, Approx.	Rs. 50	
Net value at Myingyan, per ton		Rs. 2,400
Total cost of refined metal, per ton		2,088
Operating Profit, per ton		Rs. 312
Annual profit (year is taken as 300 days)		Rs. 46,80,000
Equivalent dollars		$ 985,263

Coal used per year, apart from coal-generated power, 7,500 tons

4. SUMMARY OF CAPITAL COSTS, MYINGYAN PROJECT.

Power Plant	$4,000,000
Zinc Plant	5,000,000
Railroad extension and river-port works, possibly.....	300,000
Civic improvement and employee housing, possibly....	500,000
	$9,800,000

About two-thirds of this, or $6,500,000, will be for procurement of equipment and services outside of Burma.

Annual profit when operating at capacity for 300 days per year is estimated at close to $1,000,000, or 47.5 lakhs of rupees. Although these plants are designed for continuous, 24 hours, year-round operations, it would be optimistic to expect them to do so at full capacity, even if standby process units were provided. Therefore, profits may be expected to range upward from one-half the figures named for the first year or two.

It may be noted that no estimate is included for transformers and transmission line to Mandalay. This might cost around one million dollars and presumably would be justified by power sales in the Mandalay area. These sales, and other industries which might be expected to follow when cheap power is provided, will tend to reduce the cost of producing power, which is the largest item of expense in electrolysis of zinc.

It is probable that the proposed steam electric plant will be connected into the power transmission grid proposed in Chapter XI, Power Development. As shown therein the transmission grid will connect the proposed hydro-electric power plants with the major markets and with each other. At that time the proposed steam power plant would be operated to fulfill its most economic role in the system, which will probably be to the peak load.

H. PROJECT FOR ESTABLISHMENT OF UNION OF BURMA MINERAL DEVELOPMENT CORPORATION (UBMDC).

1. PURPOSE. The mineral resources of Burma are one of its principal assets and, in an economy such as Burma's, are the prime source of the immediate wealth which will be needed to raise the living standard of its people, pay for civic improvements and furnish the capital for starting other industry.

The mineral wealth will remain, largely, a frozen asset unless provisions are made by the Government of the Union of Burma to ensure the rapid, orderly development of its mineral resources.

It is proposed to accomplish this aim by the creation of an entirely-owned Government Corporation called the "Union of Burma Mineral Development Corporation" whose functions, activities, relationships and authority are here delineated.

2. FUNCTIONS.

a. Purchase and sale of minerals for export, now a function of the Mineral Produce Marketing Board which was established four years ago with a fund of Rs. 15,00,000. The object is to assure a continuous, stable market for small mineral producers, and to protect them from unfair practices by private buyers.

b. Loans and technical service to private mining enterprises. Loans would be made for purchase of equipment and supplies for mining developments from abroad, the capital required for domestic expenditures being supplied by the borrower. The borrower must be competent to conduct the mining enterprise and have a good business reputation. Loans would be repaid from the sale of products. Technical service would be supplied by the Corporation to mining enterprises on a cost basis, and would include:

(1) Geological counsel; examination of mineral deposits and advice on methods of exploration and development.

(2) Mine Planning; advice on planning underground and surface mining operations for maximum economic recovery of minerals.

(3) Testing of the ores in a central pilot mill for application of gravity, flotation or other methods of concentration and the design of beneficiation plants.

c. Participation in mining enterprises. In projects where the public interest is involved, the Corporation may subscribe to a minority or an equal interest in an enterprise which operates independently and on the initiative of private individuals. In such cases, the services described in Par. "b" would be supplied in the same manner as to wholly private enterprises. The Corporation would contribute capital, and would make or guarantee loans to the enterprise, on an equitable basis. The Corporation would possibly be designated as the Government's agent for participation in such mining ventures as the new "Burma Corporation (1951) Ltd.", since it will constitute, presumably, the most competent agency of the Government to implement such participations.

d. Wholly owned mining or related enterprises. In cases such as a coal-field development, which would be closely related to railroad and river transport and to electric power supply, and in others which may be in the public interest and beyond the range of private enterprise, the Corporation would develop and operate the venture on its own account. The central plant of the antimony project, elsewhere described, would be built and operated by the Corporation.

e. Procurement and maintenance of stocks of mining equipment and supplies. Included would be items needed by the industry but not locally available at reasonable prices, or at all. Such items, among others, would be:

(1) Special tools and explosives for mining use, carbide, safety lamps, safety hats, shoes and rescue equipment.

(2) Standard mining equipment, including pneumatic drills, compressors, mine cars and rails, power-generating units, mine hoists, and concentrating tables and jigs.

(3) Standard exploration equipment, including portable drills, light tractors, power hoisting and generating units, and portable assay outfits.

3. SCOPE OF ACTIVITIES. Assistance as above noted would be furnished to all mining enterprises, without distinction as to national or foreign ownership or participation. However, a principal objective would be to make the Burmese nation, ultimately, independent of foreign technical or financial assistance. This would be accomplished as rapidly as consistent with the primary requirements that the nation's mineral resources be developed rapidly.

With this in view, one of the most important activities of the Corporation would be the establishment of a training program for miners by means of apprenticeships for master miners and mine foremen, at such places as Bawdwin, Mawchi, and at certain dredging and hydraulic mines in Tenasserim. The Corporation would also assist in the selection of candidates for scholorships in geology, mining engineering and metallurgy in foreign countries.

The Corporation would begin operations with a few foreign professional geologists and engineers and as many competent Burmese professionals as may be available for the purpose. The foreign members of the staff would be replaced by Burmese as rapidly as the latter are adequately trained. General supervision and guidance would be provided by a reputable firm of consulting mining engineers.

4. RELATIONSHIPS. The Corporation's activities would be closely coordinated, initially and for so long as needed, with the following agencies:

a. The National Planning Board and the Ministry of Industry and Mines. Indeed, it might be a dependency of one or both. Its policy and activities would be governed by the priorities set up by the National Planning Board as integrated with the requirements of other existing and contemplated industries.

b. The Geological Department of the Ministry of Industry and Mines. Field studies to be carried out by the Department will outline promising areas for exploration which may be carried out by individuals under "grubstake" contracts with the Corporation.

c. The Department of Mines of the Ministry of Industry and Mines, in the following respects:

(1) To set up regulations to implement the Mining Code, affecting, for example, safety practices, certification of mine foremen, inspectors, electricians, and other skilled personnel.

(2) Liberal interpretation of the Code so as to secure the greatest possible development of valuable mineral resources.

(3) The establishment and maintenance of those safety, health, housing and welfare provisions for miners and other employees of the industry best calculated to attract a superior class of workmen with a view to their permanent employment at salaries that are in keeping with the contemplated future standards of living in Burma.

(4) Encouragement of mechanization so as to increase the output per man-day of useful minerals in order to raise the living standard progressively.

d. The Department of Public Works, for the purpose of providing communications, roads, and other transport facilities to recommended mining projects.

5. LOCATION. The Corporation's principal center of activities would be a place convenient to rail and water transport where a warehouse will be provided for the storage of equipment and supplies and the assembly of mineral products for shipment. A metallurgical research laboratory and a pilot mill for ton-scale testing would also be provided at this center.

6. AUTHORITY. The Corporation, though Government-owned, should be relatively autonomous. With provisions of enough capital to get it well under way it should be self-supporting after a period of operation. Specific enterprises such as establishment of an antimony industry may become profitable in a relatively short time. Others, such as the proposed Kalewa coal development, may not become so for ten years or more after expenditures have begun. Over a long period, the Corporation's operations should amortize the initial investment and show a profit, and should have established an operating fund for continuing or expanding activities. During this period, the mineral resources of Burma would be developed, and industries dependent on them would be established.

The Board of Directors may well consist, initially, of the Minerals Advisory Board. Ultimately, it should include leaders in banking, commerce, and persons active in private mining enterprise, as well as the heads of the Mining and Geological Departments, and secretaries of the Ministries of National Planning, and of Industry and Mines. The executive head of the Corporation should be given the widest possible latidude for carrying out the directives of the Board because the success of the enterprise will depend a great deal upon him. He should be a Burmese possessing some technical knowledge and wide business experience; above all, he should be a man with initiative and courage, willing to make a career of the Corporation and carry it through to a successful conclusion.

The autonomy which should characterize the Corporation should be emphasized. It should operate in every respect, except ownership and directorate, as a private enterprise, without the limitations of civil service, and especially, free from the red tape and lethargy that so often characterizes government enterprises in most countries.

7. ESTIMATED COST OF FOREIGN CONSULTANT SERVICES. As proposed, the Corporation will for some time need foreign managerial and technical consultant services 1) to oversee the Government's present and proposed inyestments in the mineral industry; 2) to design, purchase, and supervise construction and execution of contemplated projects 3) to conduct on-the-job domestic and foreign training programs; 4) to provide technical advisory services, particularly to small mining enterprises; 5) to administer and supervise a mineral exploration program; 6) and to generally assist in securing the maximum and most expeditious economic development of Burma's mineral resources.

It is believed that the services required for the first year could be secured by the expenditure of $500,000 plus Rs. 10,00,000. The cost for subsequent years would be subject to the requirements of the Corporation's activities as they developed thereafter.

8. PRECEDENT. Precedents for such a Government-owned but relatively autonomous corporation for development of the mineral resources of a nation exist in considerable numbers, including:

a. French Morocco: Societe des Recherches et Participations Minieres.

b. Columbia: Corporacion de Fomento Minero-Industrial.

c. Mexico: Banco Minero de Mexico.

d. Bolivia: Banco Minero.

e. Peru: Banco Minero del Peru.

f. Chile: Corporation de Fomento Industrial, Ramo de Minas.

It is recommended that these and others be studied, particularly those which have been established long enough to show positive results.

I. DEVELOPMENT OF MINERAL EXPORTS.

It is expedient to develop minerals for export so that foreign credits may be established. The tin and tungsten concentrates were, before the war, and are now being exported, chiefly to U. K. Lead metal, zinc concentrates, nickel speiss and copper matte were also shipped to the U. K. prewar. Refined oil products were shipped from the Syriam refinery.

Since the war only token shipments of these natural resource products have been made. The loss in exchange has, naturally, been felt. The program now is to achieve prewar production levels as rapidly as possible and ship the metals and minerals at today's high prices.

At today's prices half the former production would net as much or more foreign exchange than that formerly received. Therefore, it is expedient that Bawdwin mine and Namtu smelter be put on a regular production basis.

Efforts should be made to quiet the country around Mawchi so that it can operate normally and thus add its tin and tungsten concentrates to the mineral exports. At the same time the Tenasserim peninsula should be cleared of insurgent activity and both large and small producers should be encouraged to increase their output of tin and tungsten concentrates to prewar levels or higher.

Both lead carbonate and zinc carbonate ores are now being shipped from the Taunggyi area. With the building of access roads the amount can be substantially increased. Antimony ores of shipping grade are being sent to Rangoon from Lebyin and from Mong Sang and Nan Hok. The production of these ores should be stepped up as it all goes into the export market.

If the proposed metallurgical plants at Myingyan are constructed, the zinc sulphide and lead carbonate presently exported from Burma as such will be converted to metal and shipped at a higher price and with less freight cost.

Antimony oxide plants at several of the mines and a central reduction plant in Rangoon will enable Burma to export pure antimony metal instead of the ore. A higher sale price and an increased exchange value will thus be realized.

The programs developed and the recommendations that are being made by the consultants will tend to develop additional mineral production, eventually reduce much of the ore to metal form and increase realization proceeds from the export of ores and metals. At present prices for minerals, the foreign exchange position of Burma can be greatly strengthened.

J. TRAINING PROGRAM FOR MINE LABOR AND SUPERVISORY PERSONNEL.

1. GENERAL JUSTIFICATION. The need for trained and experienced mine labor, supervisory personnel and technological services in the development of production from the Kalewa coal field and the antimony deposits has been discussed under preceding captions. Similarly, in discusing the potentials of the lead and zinc deposits of the Southern Shan States, the necessity for introducing more efficient and modernized methods of development, extractive mining and ore dressing has been pointed out. So far as concerns long-established and successful prewar mining operations, such as Burma Corporation and Mawchi Mines, their dependence to date on non-indigenous mine labor and supervisory personnel has been noted.

Correlating these considerations with the greatly underdeveloped production potentialities which Burma's mineral resources are believed to possess, it is clearly evident that if the Burmese peoples themselves are henceforth to derive the maximumu social- economic benefits from the exploitation of these potentialities, their own aptitudes and skills must be developed and employed to this end.

To serve this objective, a minerals industry training program project is recommended. It is presented briefly at this itme, and in outline form only. Its formulation and presentation, in the detail which its importance justifies, is proposed at a later date following further investigation and study of all the relevant factors.

2. PROGRAM REQUIREMENTS. The program requirements are predicated on early approval of the various development projects which have been recommended under preceding headings, and the early restoration of normal conditions of security and order.

a. Immediate and Early Requirements. Trained supervisory personnel such as mine foremen and shift bosses will be needed almost at once on approval of the antimony project and the recommended development of lead and zinc ore production in the Southern Shan States area. As soon as the Kalewa coal field has been sufficiently proved by the recommended drilling program, development of the mine underground and the installation of surface plant and equipment will require trained mine and shop labor and supervision. Furthermore, so soon as conditions permit the resumption of mine production operations at Bawdwin and Mawchi, large amounts of mine labor and corresponding supervisory personnel will be needed.

b. Projected Long Term Requirements. So far as Bawdwin and Mawchi are concerned, the production rates to be resumed must depend for their earliest attainment upon a supply of mine labor and supervision which does not presently exist in Burma. These operations will immediately absorb what small supply is available. Thereafter, they will continue to absorb all the indigenous labor and supervision which can be trained over a considerable period of years.

The other mining developments outlined under "a", as expansion proceeds, will also absorb continually increasing supplies of labor and supervision as they become available.

The administrative, managerial and technological personnel which will be necessary to procure the desired development of Burma's mineral resources is also an important long-term requirement for which provision must be made.

3. RECOMMENDED PROGRAM.

a. Program for Earliest Action.

(1) Training Schools at Bawdwin and Mawchi. Under the direction of a properly qualified mining engineer,

it would be proposed to established with the cooperation of the Burma Corporation and, so soon as may be possible with that of the Mawchi Mines Limited, a school at each mine for training mine labor and supervisory personnel. Details related to the selection of candidates, the training methods to be used, the period of training and other factors essential to the success of this program, would be resolved jointly by the managements, the consultants and the appropriate Government authorities.

(2) Training Abroad. As soon as the Kalewa coal field is sufficiently proved so that the project as a whole can be approved, and a contract effected with the Company who would design the plant and supervise the development and execution of the project, it is recommended that three suitable candidates be sent to the United States for a period of one year for the purpose of acquiring experience and training in the mining and operating methods in use there, with particular reference to those methods deemed most suitable for the exploitation of the kalewa fiield. This training also would be arranged and supervised by the firm undertaking the Kalewa Project development.

b. Long Term Program. As distinct from the preceding program for earliest action, the following long-term program is recommended:

(1) The program outlined in a. (1) would be continued and expanded to the greatest degree practicable at Bawdwin and Mawchi. Similarly, advantage would be taken of the facilities for training offered by other mining operations as they developed to the stage where they could be made to serve usefully.

(2) In collaboration with the appropriate Government authorities and the consultants, the UBMDC would arrange with a foreign company specializing in coal and metal mining management for the conduct and supervision of a three-year period of training in the United States for four Burmese mining engineers and two metallurgical engineers.

c. The Total Cost of Training Program. The total cost of the program, as included in the estimates under H. 7, can only be regarded as tentative, although it does take into account to the extent presently possible the cost of the foreign personnel which would be required in Burma and abroad.

d. Rangoon University School of Mineral Sciences. The Rangoon University presently offers a limited number of courses in geology, and none in mining. It is the opinion of the consultants that a school of mineral sciences should be established in the University under the direction of a highly qualified Dean. The curricula, functions and facilities which such a school should possess in order best to serve Burma's more pressing requirements would be determined by the appropriate Government authorities.

4. PROGRAM IMPLEMENTATION AND EXECUTION.

a. General Recommendations.

(1) The Union of Burma Mineral Development Corporation (UBMDC). The proposed Union of Burma Mineral Development Corporation is believed by the consultants to be the entity best suited to undertake and secure the successful execution of the recommended training program. As proposed, it would be established with the requisite authority and financial facilities.

(2) In undertaking such a program, it is believed thae the Corporation could secure the most expeditious and successful results by arranging to secure the managerial, supervisory and technical services required from abroad until Burmese replacements become available.

K. CONCLUSIONS AND PROGRAM OF FURTHER WORK

1. This part of the Preliminary Report concerning the mineral resources of Burma, including recommendations for prospecting and exploration, proposed mining development, mineral industry construction projects and general economic treatment of the mining industry is presented as a program for more comprehensive study and implementation during the succeeding eighteen months or more.

The field observations and the office studies were made over a period of four months—September 1951 to January 1952—by a two man team. Their work was seriously handicapped by inability to move about freely in the field, due to political unrest. Certain vital areas were visited, however, and first-hand facts were obtained which should make the recommendations dynamic in character rather than static.

2. In summary, the following recommendations are presented:

a. The Government should give immediate consideration to the formation of the "Union of Burma Mineral Development Corporation (UBMDC)" as the most effective vehicle for assisting independent operators and organized mining ventures in securing the maximum economic development of Burma's mineral resources.

b. Through this Corporation, the Government should undertake the "Antimony Project". The field engineers should make a study of the Kadaik mine, southeast of Thaton, security conditions permitting. They should also examine the Lebyin mines, west of Kalaw, and the several deposits and mines in the Mong Nawng area, 100 miles northeast of Taunggyi. These examinations and studies are prerequisites for the selection of a demonstra-

tion mine and buildings of an oxide plant. This last step should be taken only after suitable reserves of antimony ores have been established.

c. Simultaneously, UBMDC should undertake the "Kalewa Coal Project" and expedite the initial prospecting stages upon which furtherance of the "Kalewa Project" must depend. Drills and other equipment must be ordered from abroad and time must be allowed for delivery. There is an engineer on hand to push this work.

d. The Consulting Engineer staff should be increased to provide a resident engineer to be stationed in the Taunggyi area so that comprehensive investigations can be made of the more important mineral occurences in the Southern Shan States (see map).

e. The Burma Corporation (1951) Limited should be kept advised on the development of the "Myingyan Project" as it would benefit greatly from the operation of an electrolytic zinc-reduction plant and the products recovered therefrom.

f. A study of the Budget for the fiscal year 1952 indicates that the Ministry of Mines, the Gelogical Survey and the Mines Department will receive for administration and for scientific work only 0.04 per cent of the total expenditures budgeted (if the figures have been correctly interpreted). Considering the present and potential importance of the mineral industry to the economy of Burma, this allotment is extremely small. If the mines that were operating before the war were today producing their wealth at a comparable rate, and the production of new enterprises were included, and the total production were valued at present sales prices, the mining industry would rank very near the top in its contribution to the economy of the country.

In view of these considerations, it is recommended that the Geological Survey be greatly enlarged in personnel and facilities in order to meet the growing requirement for studies of mineralized areas and specific mineral deposits. The Survey, if adequately staffed, can be of great service to the industry and to an important expansion of the mineral economy of the country.

g. Similarly, the personnel and functions of the Mines Department should be expanded although its requirements are not so great as those of the Geological Survey.

h. Relief should be granted the Mining Industry in respect of the labor laws that ban importation of foreign labor in competition with Burmese labor. One of the factors that helped Bawdwin and Mawchi to become great mines was the unrestricted use of Gurkha, Chinese and Indian labor. Many were and are now experienced in mining work and smelter operation. Few indigenous peoples are but, of course, they can become experienced in time. During the training period of the indigenous labor, the mining industry will experience irretrievable losses unless it can bring back at least a nucleus of its former employees who not only will work to rehabilitate the properties, put the mines in the production category again, but will be able to train the local peoples in mining and kindred mineral industries work. This problem is so important that it should receive immediate consideration.

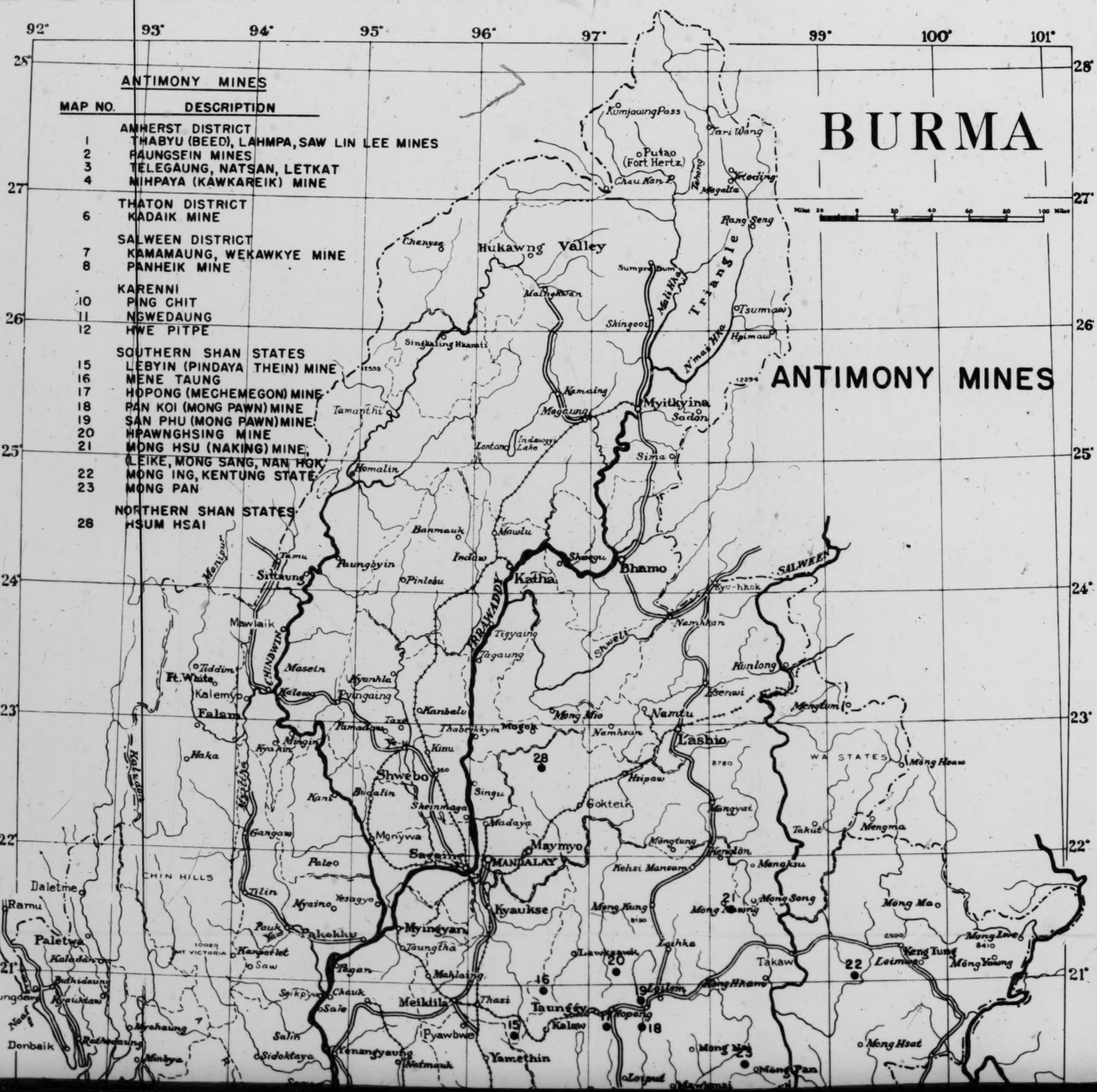
i. The Consultants have not had time to study the mining code and the taxation structure as they may relate to the maximum development of Burma's mineral resources. This matter should receive careful attention at an early date. Great care should be taken not to hamper the mining industry by the leyying of unnecessary or restrictive taxes. Relief from payment of import duties on foreign-purchased machinery and other types of mining equipment should be granted, at least to new enterprises. Everything should be done to encourage the development of the mineral industries. Recommendation has been made for the establishment of a Mineral Development Corporation that can operate in a very flexible manner. It can acquire interests in new mining projects, it can loan money to, purchase foreign-manufactured equipment for, and furnish technical help, administrative and managerial services to new mining ventures. And, it can establish new mining industries solely on its own account. It should be allowed to operate tax-free at least for a period of time, and to acquire foreign-made equipment for distribution without paying import duties.

j. A training program for employees in the mining industry should be inaugurated. There should be a demand for men who can qualify for jobs as shift boss, mine foreman and other more responsible positions. On a higher level, young men with certain qualifications and education can be trained as junior engineers for surface and underground work. The training program should be under the direction of the Union of Burma Mineral Development Corporation.

k. When additional cement-making facilities are needed, consideration should be given to establishing them where cheap power will be available, the source of raw materials economically convenient and where distribution from a central point will be facilitated. Myingyan would appear to be a suitable location for such a plant.

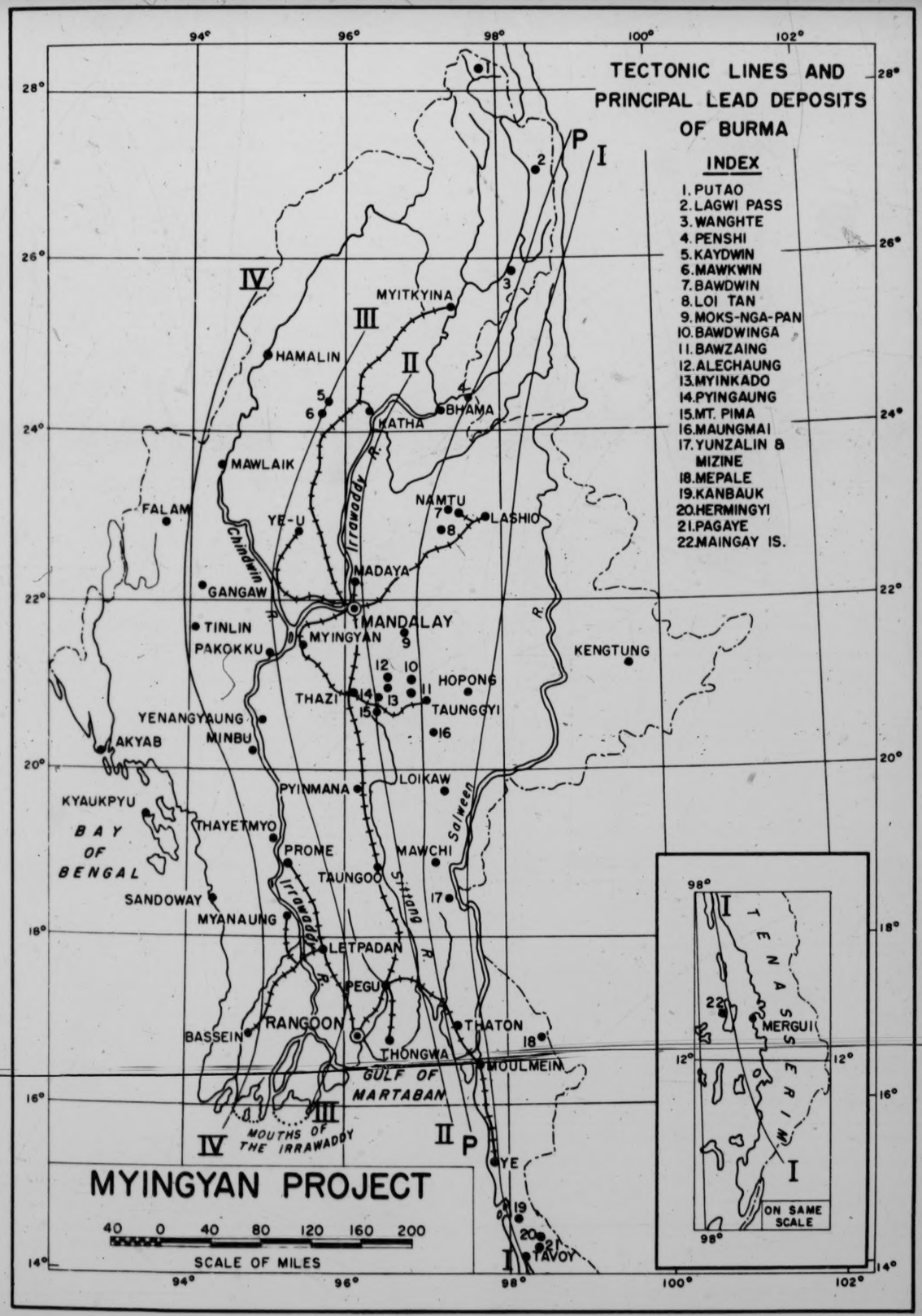
The same justifications may be presented with respect to other industrial plants. It must be emphasized, however, that the development of Myingyan as an industrial center is dependent entirely upon the success of the Kalewa project and the availability of cheap power at Myingyam, either from coal or from coal-generated electricity used in conjunction with low-cost hydro-electric energy.

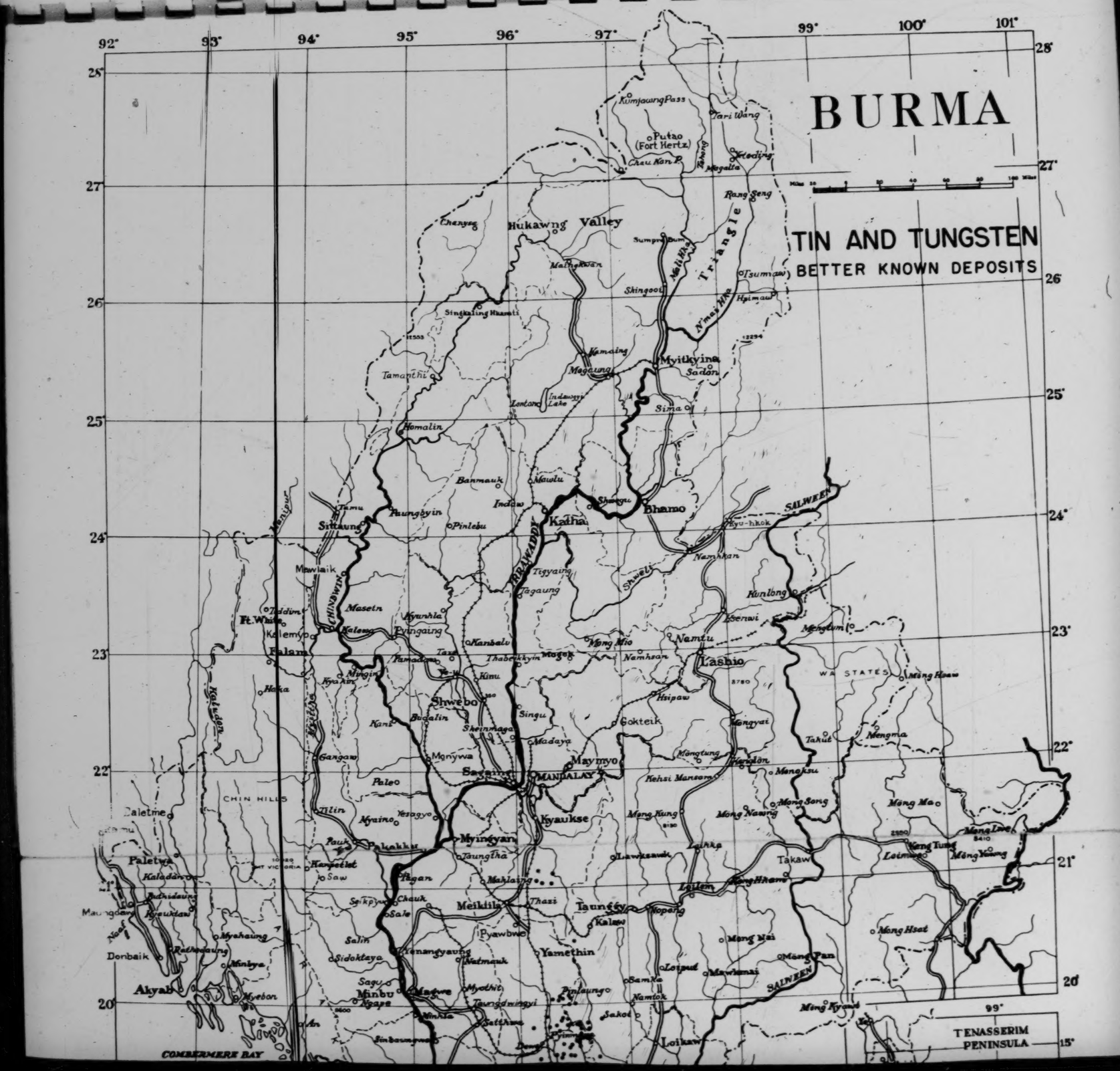
3. CONTINUING ACTIVITIES OF CONSULTING ENGINEER. The following subjects are now on the agenda for the coming months:

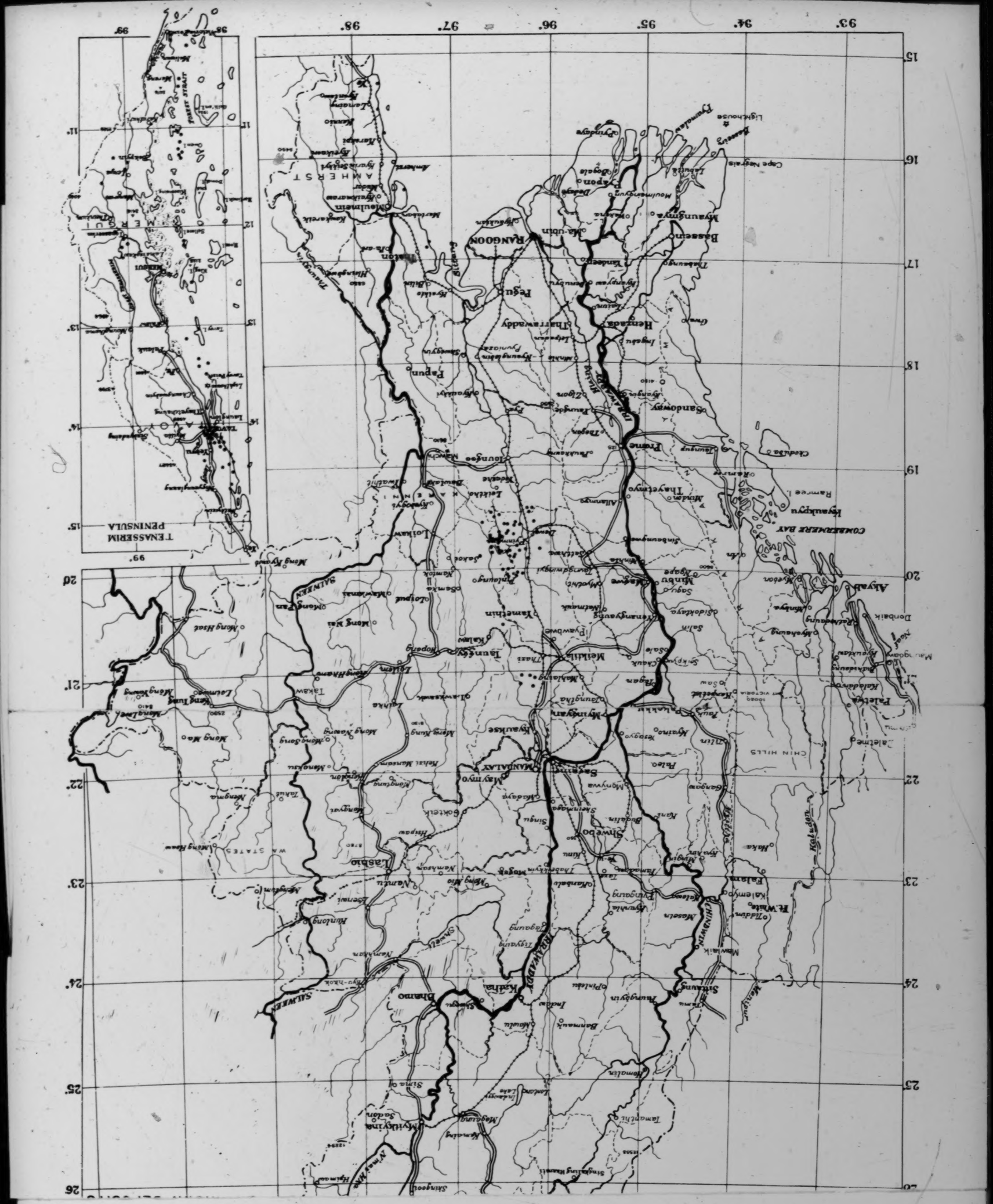

ANTIMONY MINES
MAP NO. DESCRIPTION
AMHERST DISTRICT
1 THABYU (BEED), LAHMPA, SAW LIN LEE MINES
2 PAUNGSEIN MINES
3 TELEGAUNG, NATSAN, LETKAT
4 MIHPAYA (KAWKAREIK) MINE
THATON DISTRICT
6 KADAIK MINE
SALWEEN DISTRICT
7 KAMAMAUNG, WEKAWKYE MINE
8 PANHEIK MINE
KARENNI
10 PING CHIT
11 NGWEDAUNG
12 HWE PITPE
SOUTHERN SHAN STATES
15 LEBYIN (PINDAYA THEIN) MINE
16 MENE TAUNG
17 HOPONG (MECHEMEGON) MINE
18 PAN KOI (MONG PAWN) MINE
19 SAN PHU (MONG PAWN) MINE
20 HPAWNGHSING MINE
21 MONG HSU (NAKING) MINE
CLEIKE, MONG SANG, NAN HOK
22 MONG ING, KENTUNG STATE
23 MONG PAN
NORTHERN SHAN STATES
28 HSUM HSAI
BURMA
ANTIMONY MINES
92° 93° 94° 95° 96° 97° 98° 99° 100° 101°
28° 27° 26° 25° 24° 23° 22° 21°
Kumjawng Pass
Putao (Fort Hertz)
Tari Wang
Hkoding
Hukawng Valley
Triangle
Tsuman
Hpimaw
Myitkyina
Sadon
Sima
Bhamo
Katha
Shwegu
Indaw
Mawlu
Banmauk
Homalin
Tamanthi
Kamaing
Mogaung
Sittaung
Pinlebu
Mawlaik
Falam
Tiddim
Ft. White
Kalemyo
Haka
Shwebo
Monywa
Sagaing
MANDALAY
Maymyo
Kyaukse
Myingyan
Pakokku
Meiktila
Thazi
Yamethin
Pyawbwe
Taunggyi
Loilem
Hopong
Kalaw
Lawksawk
Pekon
Takaw
Kehsi Mansam
Mongkaing
Mongnai
Mongpan
Mongsang
Mongyai
Mongton
Hsipaw
Goktein
Lashio
Namtu
Namhkan
Kunlong
Mongyum
Mong Hsat
Mong Hsu
Mong Pan
Mong Mao
Mong Lwe
Mong Yawng
Mong Tung
Mong Haw
WA STATES
CHIN HILLS
Mt. Victoria
Paletwa
Ramu
Daletme
Donbaik
Maungdaw
Kyaukpyu
Sandoway
Thayetmyo
Minbya
Salin
Yenangyaung
Chauk
Yenangyat
Kyaukpadaung
Myingyan
Pakokku
Kyaukse
Meiktila
Thazi
Yamethin
Pyawbwe
Taunggyi
Loilem
Hopong
Kalaw
Lawksawk
Pekon
Takaw
Kehsi Mansam
Mongkaing
Mongnai
Mongpan
Mongsang
Mongyai
Mongton
Hsipaw
Goktein
Lashio
Namtu
Namhkan
Kunlong
Mongyum
Mong Hsat
Mong Hsu
Mong Pan
Mong Mao
Mong Lwe
Mong Yawng
Mong Tung
Mong Haw
WA STATES
Hukawng Valley
Triangle
Tsuman
Hpimaw
Myitkyina
Sadon
Sima
Bhamo
Katha
Shwegu
Indaw
Mawlu
Banmauk
Homalin
Tamanthi
Kamaing
Mogaung
Sittaung
Pinlebu
Mawlaik
Falam
Tiddim
Ft. White
Kalemyo
Haka
Shwebo
Monywa
Sagaing
MANDALAY
Maymyo
Kyaukse
Myingyan
Pakokku
Meiktila
Thazi
Yamethin
Pyawbwe
Taunggyi
Loilem
Hopong
Kalaw
Lawksawk
Pekon
Takaw
Kehsi Mansam
Mongkaing
Mongnai
Mongpan
Mongsang
Mongyai
Mongton
Hsipaw
Goktein
Lashio
Namtu
Namhkan
Kunlong
Mongyum
Mong Hsat
Mong Hsu
Mong Pan
Mong Mao
Mong Lwe
Mong Yawng
Mong Tung
Mong Haw
WA STATES
CHIN HILLS
Mt. Victoria
Paletwa
Ramu
Daletme
Donbaik
Maungdaw
Kyaukpyu
Sandoway
Thayetmyo
Minbya
Salin
Yenangyaung
Chauk
Yenangyat
Kyaukpadaung
Myingyan
Pakokku
Kyaukse

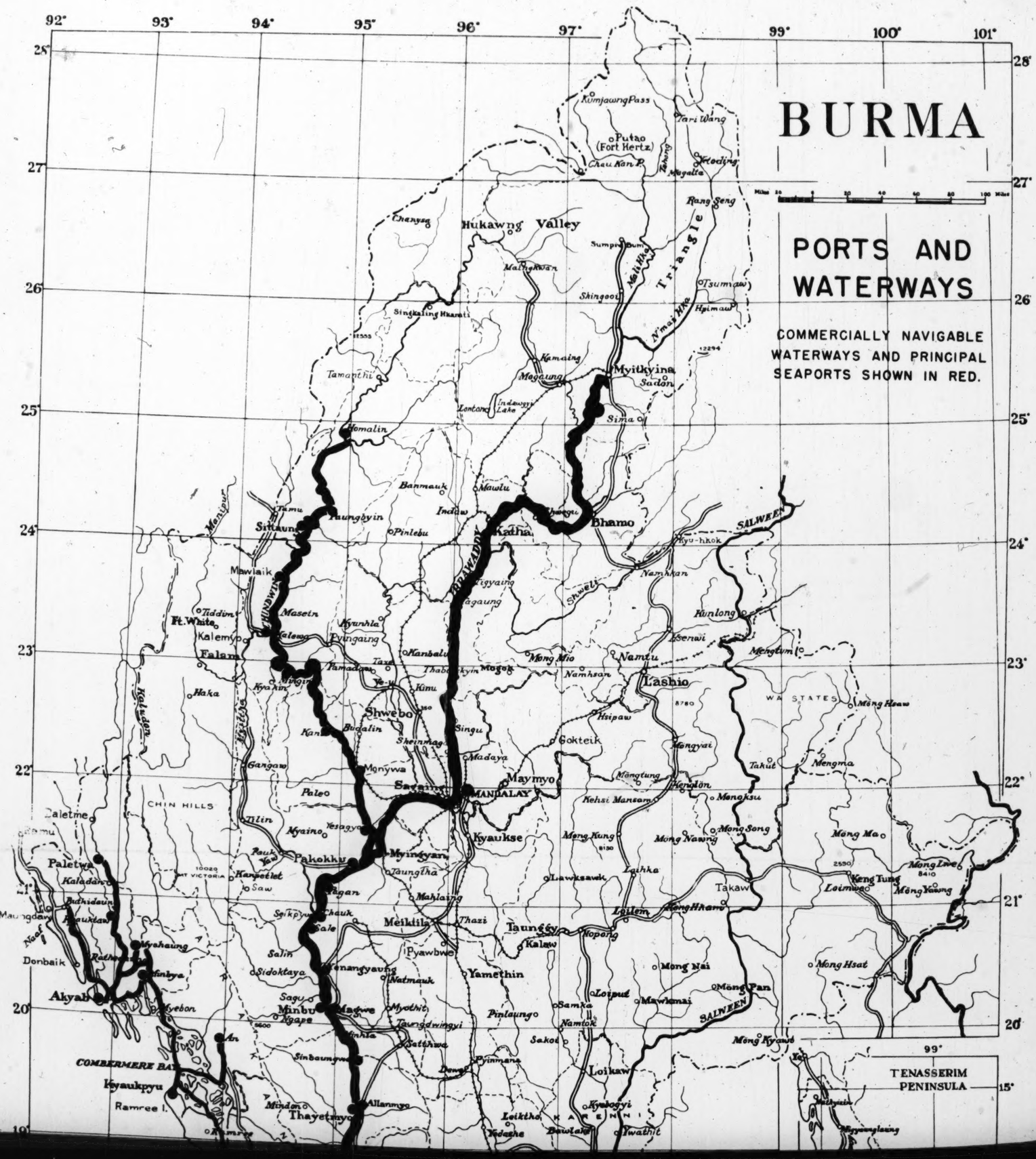
17 HOPONG (MECHEMEGON) MINE
18 PANGKOI (MONG PAWN) MINE
19 SAN PHU (MONG PAWN) MINE
20 HPAWNGHSING MINE
21 MONG HSU (NAKING) MINE
22 MONG ING, KENTUNG STATE
(LEIKE, MONG SANG, NAN HOK)
23 MONG PAN

NORTHERN SHAN STATES
28 HSUM HSAI


TECTONIC LINES AND PRINCIPAL LEAD DEPOSITS OF BURMA
INDEX
1. PUTAO
2. LAGWI PASS
3. WANGHTE
4. PENSHI
5. KAYDWIN
6. MAWKWIN
7. BAWDWIN
8. LOI TAN
9. MOKS-NGA-PAN
10. BAWDWINGA
11. BAWZAING
12. ALECHAUNG
13. MYINKADO
14. PYINGAUNG
15. MT. PIMA
16. MAUNGMAI
17. YUNZALIN & MIZINE
18. MEPALE
19. KANBAUK
20. HERMINGYI
21. PAGAYE
22. MAINGAY IS.
MYITKYINA
HAMALIN
BHAMO
KATHA
MAWLAIK
FALAM
YE-U
NAMTU
LASHIO
MADAYA
GANGAW
MANDALAY
TINLIN
PAKOKKU
MYINGYAN
KENGTUNG
HOPONG
THAZI
TAUNGGYI
YENANGYAUNG
MINBU
AKYAB
PYINMANA
LOIKAW
KYAUKPYU
BAY OF BENGAL
THAYETMYO
PROME
MAWCHI
TAUNGOO
SANDOWAY
MYANAUNG
LETPADAN
PEGU
RANGOON
BASSEIN
THATON
THONGWA
MOULMEIN
GULF OF MARTABAN
MOUTHS OF THE IRRAWADDY
YE
TAVOY
Irrawaddy R.
Chindwin R.
Sittang R.
Salween R.
TENASSERIM
ON SAME SCALE
MYINGYAN PROJECT
40 0 40 80 120 160 200
SCALE OF MILES
94°
96°
98°
100°
102°
28°
26°
24°
22°
20°
18°
16°
14°
12°

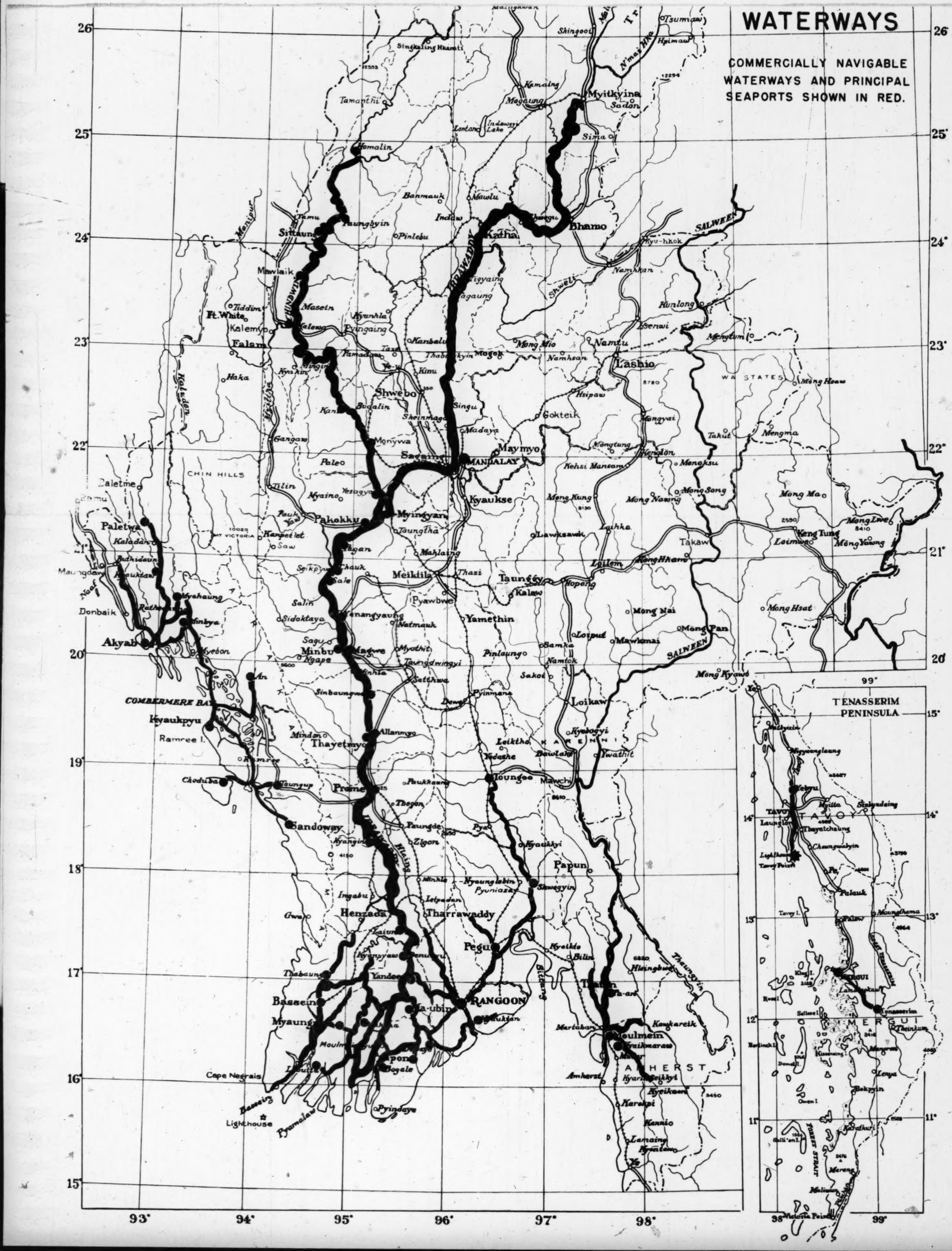

BURMA
TIN AND TUNGSTEN
BETTER KNOWN DEPOSITS
Hukawng Valley
Triangle
Putao (Fort Hertz)
Kumjaung Pass
Myitkyina
Bhamo
Katha
Sittaung
Shwebo
Sagaing
MANDALAY
Maymyo
Kyaukse
Myingyan
Meiktila
Yamethin
Pyawbwe
Taunggyi
Kalaw
Loilem
Takaw
Lashio
Namtu
Hsipaw
Kehsi Mansam
Mong Nawng
Mong Kung
Mong Yai
Mong Pan
Mong Hsat
Mong Hsu
Mong Ma
Mong Lwe
Mong Yawng
Mong Hsaing
Mong Kyawt
Takut
Mengma
Kunlong
Namhkan
Myitson
Tigyaing
Shwegu
Indaw
Mawlu
Banmauk
Homalin
Tamanthi
Singkaling Hkamti
Hkamaing
Mogaung
Sima
Sadon
Hpimaw
Tsuman
Shingbwiyang
Maingkwan
Rang Seng
Mogaung
Tari Wang
Kreding
Mogaita
Chau Nan R.
Putao
Kumjaung Pass
Chaungzon
Yesagyo
Myaing
Pauk
Pakokku
Pagan
Salin
Sidoktaya
Yenangyaung
Minbu
Magwe
Myothit
Taungdwingyi
Pinlaung
Namtok
Loikaw
Sakot
Akyab
Minbya
Myebon
Donbaik
Kyaukpyu
Sandoway
Thandwe
Gwa
Ramree
Cheduba
Kyaukpyu
Sale
Chauk
Thazi
Meiktila
Kalaw
Nopeng
Loilem
Laukkaung
Leikha
Mong Hsu
Mong Yawng
Mong Hsaing
Mong Kyawt
Mong Pan
Mong Hsat
Mong Mai
Mawkmai
Loipot
Samka
Namtok
Sakot
Loikaw
Pinlaung
Taunggwingyi
Myothit
Magwe
Minbu
Yenangyaung
Sidoktaya
Salin
Pyawbwe
Yamethin
Meiktila
Thazi
Taunggyi
Kalaw
Nopeng
Loilem
Laukkaung
Leikha
Takaw
Mong Hsaing
Mong Yawng
Mong Hsu
Mong Ma
Mong Lwe


93°
94°
95°
96°
97°
98°
99°
15°
16°
17°
18°
19°
20°
21°
22°
23°
24°
25°
26°
RANGOON
Pegu
Henzada
Thatkaung
Bassein
Myaungmya
Bassein
Thabeton
Tenasserim
Papun
Sandoway
Prome
Thayetmyo
Minbu
Magwe
Myingyan
Meiktila
Yamethin
Taungdwingyi
Loikaw
Lashio
Kyaukpyu
Akyab
Sittaung
Shwebo
Monywa
Kyaukse
Mandalay
Sagaing
Myitkyina
Bhamo
Katha
Kindat
Tamanthi
Homalin
Kalewa
Kalemyo
Falam
Haka
Gangaw
Pakokku
Yenangyaung
Chauk
Salin
Pyawbwe
Kalaw
Taunggyi
Loilem
Mong Nai
Mong Hsat
Mong Mao
Mong Yawng
Mong Nawng
Mong Kung
Mong Hsu
Mong Pan
Mong Yang
Lashio
Namtu
Namhsan
Kehsi Mansam
Hsipaw
Thibaw
Maymyo
Meiktila
Myingyan
Yenangyaung
Chauk
Salin
Pakokku
Monywa
Shwebo
Sagaing
Mandalay
Kyaukse
Myitkyina
Bhamo
Katha
Kindat
Tamanthi
Homalin
Kalewa
Kalemyo
Falam
Haka
Gangaw
Sittaung
Pyinmana
Toungoo
Prome
Thayetmyo
Henzada
Thatkaung
Bassein
Myaungmya
Bassein
Thabeton
Papun
Sandowey
Tenasserim
Mergui
Victoria Peak
Cape Negrais
Lighthouse
Diamond I.
Ramree I.
Cheduba
Preparis I.
Landfall I.
Alguada Reef
Table I.
Elephant Point
Haigyi I.
Negrais


BURMA
PORTS AND WATERWAYS
COMMERCIALLY NAVIGABLE WATERWAYS AND PRINCIPAL SEAPORTS SHOWN IN RED.
92°
93°
94°
95°
96°
97°
98°
99°
100°
101°
28°
27°
26°
25°
24°
23°
22°
21°
20°
19°
Kumjawng Pass
Putao (Fort Hertz)
Tari Wang
Hkoding
Hukawng Valley
Chanyay
Rang Seng
Tsumaw
Hpimaw
Singkaling Hkamti
Tamanthi
Kamaing
Myitkyina
Sadon
Homalin
Sima
Banmauk
Mawlu
Indaw
Katha
Bhamo
Sittaung
Taungbyin
Pinlebu
Mawlaik
Ft. White
Kalemyo
Falam
Tiddim
Haka
Kalewa
Pyingaing
Kyaukse
Maymyo
MANDALAY
Meiktila
Thazi
Pyawbwe
Yamethin
Shwebo
Monywa
Sagaing
Ye-U
Kanbalu
Singu
Madaya
Gokteik
Hsipaw
Lashio
Namtu
Namhsan
Mong Mio
Hsenwi
Hunlong
Mongyai
Takaw
Lawksawk
Loilem
Nopong
Kalaw
Taunggyi
Mong Nai
Loilong
Mong Pan
Mong Hsat
Mong Kung
Mong Nawng
Mong Song
Mong Ma
Mong Lwe
Keng Tung
Mong Yaung
Loimwe
Mong Hkam
Kehsi Mansam
Mongtung
Mongyai
Takut
Mengma
Monaksu
Mong Hsaw
WA STATES
Mong Kyawt
Loikaw
Kyaukpyu
Ramree I.
Thayetmyo
Minbu
Akyab
Paletwa
Pakokku
Myingyan
Taungtha
Salin
Sidoktaya
Yenangyaung
Natmauk
Myothit
Pinlaungo
Sakoe
Namtok
Samka
Loilut
Mawkmai
Kyaukpyu
Ramree I.
Minbon
Allanmyo
Loikaw
Kyaboyyi
Ywathit
Loikaw
Bawlake
Yadashe
Paletwa
Mindat
Matupi
Myohaung
Donbaik
Maungdaw
Buthidaung
Kanpetlet
Mt. Victoria
10020
Saw
Pauk Yaw
Myaing
Yesagyo
Tilin
Gangaw
Paleo
Kan
Budalin
Shenmagay
Kyaukpyu
Ramree I.
Thayetmyo

WATERWAYS

COMMERCIALLY NAVIGABLE WATERWAYS AND PRINCIPAL SEAPORTS SHOWN IN RED.


Tsuman
Shingool
Hpimaw
Singkaling Hkamti
Kamaing
Myitkyina
Sadon
Tamanthi
Lanlang
Indawgyi Lake
Sima
Homalin
Banmauk
Mawlu
Indaw
Katha
Bhamo
Sittaung
Pinlebu
Mawlaik
Tiddim
Ft. White
Kalemyo
Falam
Haka
Kalewa
Tyingaing
Masein
Kyunhla
Hanbalu
Mogok
Mong Mio
Namtu
Namhkan
Kunlong
Lashio
Hsipaw
Shwebo
Singu
Madaya
Gokteik
Mongyai
Takut
Mengma
Monywa
Maymyo
MANDALAY
Sagaing
Kehsi Mansam
Monglon
Monaksu
Paleo
CHIN HILLS
Kyaukse
Mong Kung
Mong Nawng
Mong Song
Mong Ma
Paletwa
Myinkyan
Pakokku
Lawksawk
Loilkha
Takaw
Keng Tung
Mong Yawng
Meiktila
Thazi
Taunggyi
Loilem
Hopong
Mong Hsat
Donbaik
Akyab
Minbu
Magwe
Yenangyaung
Yamethin
Mong Nai
Mong Pan
Sidoktaya
Natmauk
Pyawbwe
Kalaw
Lopud
Mawkmai
Pinlaung
Namtok
Sakoe
Mong Kyawt
Kyaukpyu
COMBERMERE BAY
Ramree I.
Thayetmyo
Allanmyo
Loikaw
Kyaboggyi
Leiktho
Yedashe
Dawlaka
Iwathit
Chedubà
Prome
Taungup
Paukkaung
Toungoo
Mawchi
Sandoway
Thegon
Paungde
Pyay
Kyaukkyi
Papun
Myaunglobin
Pyuniazat
Shwegyin
Henzada
Tharrawaddy
Ingabu
Letpadan
Pegu
Kyeikto
Bilin
Hlaingbwe
Thaungyin
Thabaung
Yandee
RANGOON
Bassein
Myaung Mya
Ma-ubin
Moulmein
Martaban
Kaukareik
Amherst
Kyaikkami
Kyaikkeo
Karakpi
Kannio
Lamaing
Cape Negrais
Lighthouse
Pyindaye
Bogale
Pyamalaw
Bassein
Paletwa
Kaladan
Akyab
Donbaik
Myebon
Ramree
Chedubà
Sandoway
Cape Negrais
Moulmein
Amherst
Tavoy
Mergui
Victoria Point
TENASSERIM PENINSULA
TAVOY
MERGUI
ARAKAN
SALWEEN
HUKAWNG VALLEY
HUKAWNG
MANIPUR
KALADAN
MYITKYINA
Tavoy I.
King I.
Forest Strait
Queen I.
Elphinstone I.
Merguí I.
Sellore I.
Rosiers I.
Domel I.
Kisseraing
Lenya
Bokpyin
Kadathuri
Merong
Malissa
Mergui
Tenasserim
Palauk
Maungkama
Thayetchaung
Launglon
Myitta
Sinkyadaing
Yebyu
Kyunsaloung
Tavoy Point
Lighthouse
Pa
Chaungwalyin
Kaleinaung
Mong Hsaw
WA STATES
Mong Lwe
Mong Yawng
Keng Tung
Laimong
Mong Hsaw
Mong Pan
Mong Nai
Mong Hsat
Mong Ma
Mong Song
Mong Nawng
Mong Kung
Lawksawk
Loilkha
Takaw
Kehsi Mansam
Monglon
Monaksu
Mengma
Takut
Mongyai
Hsipaw
Lashio
Namtu
Mong Mio
Namhsan
Mogok
Hanbalu
Tagaung
Shwebo
Singu
Madaya
Monywa
Sagaing
Maymyo
MANDALAY
Kyaukse
Myingyan
Pakokku

a. A field study of some of the more important deposits of iron ore should be made to determine definitely if there is a deposit which could support a small iron and steel industry in Burma.

b. Efforts should be made to determine the operational requirements of individual and small-company operators in Tenasserim so that the production of tin and tungsten concentrates can be increased and greater benefits obtained from the present high prices and expanding demand.

c. A study of the site for the industrial development of Myingyan should be started, tests made on the burning and briquetting qualities of the Kalewa coal, metallurgical studies made on the zinc sulphide concentrates and the flow sheet of the proposed plant including utilization of the furnace gases. The other steps outlined in the report on the "Myingyan Project" should be executed in the most expeditious manner.

d. As soon as drilling of the Kalewa Coal Field has progressed far enough to justify complete development of the project, a project report will be submitted and studies will begin on the transportation problems which will be involved in loading and moving about 375,000 tons of coal per year from Kalewa to Myingyan by barge; and then, after proper processing, the movement of probably 150,000 to 180,000 tons per year by railroad, and 120,000 to 150,000 tons by barge from Myingyan to the lower delta communities.

e. A reconnaissance of the geologically-favorable areas in North Burma is recommended. More detailed investigation would follow where justified. The Consultants had no opportunity to visit this large section.

f. The following duties and studies will be undertaken by the resident engineer for the Southern Shan States if he is appointed:

(1) The engineer will advise and assist in developing lead production in the Mawson area and determine the extent to which more modern methods of mining and ore dressing are adaptable to these deposits.

(2) The engineer would examine the Lough Keng zinc deposit of the Shwedaung Zinc Mines Company and, if the reserves are ample, recommend the construction of a road from the mine to Mong Pawn.

(3) The engineer would also determine the economic justification for an access road to the Mong Sang and the Nan Hok antimony mines, and whether an oxide plant is needed near railhead to reduce the ores obtained from these mines.

(4) The engineer, when able, should see if any of the coal deposits in the Taunggyi area near Kalaw could be economically mined and utilized for the production of coke. Many other mining and mineral deposits in this important mineral area will require investigation.

g. A study and report will be made to determine the economics and advisability of processing all high-grade antimony ore in the first stage of the antimony project and, thereby, ship only antimony metal from Burma.

Section VII

INDUSTRIES

A. EXISTING INDUSTRIES.

Manufacturing industry in Burma, in some instances long established, is only in the early stages of development. This is evidenced by the relatively small number of persons employed, the limited variety and value of goods produced, the relatively small amounts of capital invested in plant and equipment and the primitive methods of production employed.

1. While no comprehensive statistics of current industrial production are available, partial statistics compiled by the Labour Directorate (Burma Labour Gazette, September 1951) indicate there are some 882 rice mills, 110 sesamum and groundnut oil extraction plants, 80 flour mills, 3 sugar extraction and refining mills, 16 beverage plants, 194 saw mills, 67 cotton ginning and spinning plants, 3 match factories, 1 cement and a few tobacco, rope, printing and engineering plants. In addition to these, there exist a few glass factories, steel re-rolling mills and probably a number of other manufacturing establishments as yet unreported. The size of Burma's manufacturing plants is suggested by incomplete employment figures, which show some 43,000 permanent workers engaged in those establishments reporting to the Labour Directorate. (See Table VII in Section II.) Even if this number represents only one-half or one-third of the permanent labor force engaged in manufacturing industry, and even if the augmented total were adjusted to take into account temporary employment as well, it would indicate a low state of industrial development, when compared with a labor force in excess of 8 million people.

2. Factory or plant production is supplemented by a cottage industry comprising many small scale producers and by home and handicraft producers. Most cottage industry production, however, appears to be conducted on a part-time basis by farm and village people who work primarily on the farms, and who engage in cottage industry only in the agricultural off-season. The output of these small industries includes handloomed cloth, pottery, lacquerware, basket weaving, parasols and similar articles. While the value of this output is difficult to estimate, it cannot be significant in relation to the total national product.

3. Generally speaking, the plant and equipment used in current manufacturing are primitive or outmoded; the possibilities of division and specialization of labor are only incompletely realized, the necessary technicians even in relation to existing production set-ups are frequently lacking and management techniques need considerable improvement.

B. THE NEED FOR INDUSTRIAL DEVELOPMENT.

Burma needs industrial development urgently to provide more productive work opportunities for her growing population and labor force, to increase per capita productivity and output, to provide greater stability in her economy, and to reduce importation of the types of consumer goods which can be efficiently produced at home, so a larger part of her foreign exchange can be spent for industrial raw materials and for machinery.

1. Even before World War II, it appears that agriculture and the extractive industries absorbed as large a working population as could be afforded a reasonable standard of living out of their produce at that time. In fact, the application of modern equipment and techniques might have reduced the number of people who could be provided with a livelihood on the farms, in the forests and in the mines. Since that time, the population and labor force have grown considerably. A considerable industrial expanison, as well as expansion in the fields of public works, trade, special services, etc., will be required to provide productive work opportunities for this growing labor force.

2. If industrial development is undertaken in fields in which Burma can economically engage, there is no question but that the advantages of division of labor, specialization, utilization of machine equipment and modern methods of production will result in a far greater per capita output than currently prevails in agriculture and the extractive industries. Increases in per capita output in the field of industry will raise the gross national per capita output. Industry will raise per capita output in other fields by drawing surplus and unproductively employed labor from these fields.

3. Burma before the war was dependent on the production and export of a few key items—rice, petroleum products, a few minerals and forest products. Unfavoable trends in world markets and prices for these items produced an unfavorable reaction on Burma's domestic economy. Industrial development will introduce a better balance and a greater stability in the Burmese economy.

4. The amount of foreign exchange Burma can accumulate is limited by her exports and the world prices they command. It is important that her limited foreign exchange be utilized to maximum advantage. The more consumers' goods imported, the less industrial raw material and machinery she can buy. Industrial development is needed to produce a number of consumers' goods items, to conserve foreign exchange so that an increased degree of industrial expansion can be achieved.

C. MATERIAL RESOURCES FOR INDUSTRIAL DEVELOPMENT.

Burma's industrial potential is determined by her natural resources, her labor force, the capital equipment she has or can obtain, and the managerial resources and technological skills she can muster. Assuming a large, adaptable and available labor force, Burma's natural resources are the basic starting point for evaluating her industrial potential. Some of the industrial possibilities provided by Burma's animal, vegetable and mineral resources are indicated below:

1. INDUSTRIES AND PLANTS BASED ON ANIMAL RESOURCES.

a. Meats: Not produced in sufficient quantities for industrialization at the present time.

b. Fish:

(1) Construction of boats, manufacture of nets and other commercial fishing equipment.
(2) Processing plants—canneries and preserving.
(3) Ice and cold storage plants.
(4) By-product processsing of offal, and conversion of non-edible fish for fertilizer, animal feed and vitamins, and fish oil.
(5) Shark fishing by-products—skins, liver oil and edible oils.
(6) Shell fish canning.

c. Milk and Milk Products:

(1) Dairy plant—condensed milk, cheese and industrial by-product production.

2. INDUSTRIES AND PLANTS BASED ON VEGETABLE RESOURCES.

a. Food and Its By-products:

(1) Modernization of rice milling facilities.
(2) By-product extraction of oil from rice bran for cooking, soap-making.
(3) Paper board from rice straw and waste paper.
(4) Bag manufacture from rice straw.
(5) Groundnut edible oil extraction.
(6) Sesamum—oil and animal feed.
(7) Soy bean oil extraction for soap and hydrogenated edible fats. By-products cakes for animal feed.
(8) Cotton seed oil extraction for soap, edible oil and hydrogenated edible fats. By-product cake for stock feed.
(9) Sugar refining and by-products.

b. Textile Fibers:

(1) Cotton gins—seed extraction and collection of edible oil plant.
(2) Spinning mills.
(3) Weaving mills.

c. Cordage Fibers:

(1) Hemp (abaca) rope-making plants.

d. Bamboo:

(1) Pulp and paper plant for printing (exclusive of newsprint) and writing papers.
(2) Manufactured products, such as furniture, umbrellas, canes, shades.

e. Lumber:

(1) Structural.
(2) Millwork.

f. Rubber:

(1) Plant for shoes and bicycle tires for local consumption.

g. Herbs, Roots, Barks, Flowers, etc..

(1) Pharmaceuticals, insecticides, pesticides.
(2) Essential oils.
(3) Antibiotics—penicillin, etc.
(4) Tobacco and tobacco products.
(5) Lac.
(6) Tung oil.
(7) Cutch.

3. INDUSTRIES AND PLANTS BASED ON MINERAL RESOURCES.

a. Petroleum and Petroleum Products:

(1) Gasoline.
(2) Diesel fuel.
(3) Heavy fuel oils.

(4) Lubricating oils.
(5) Greases.

b. Refinery By-Products:
(1) Anhydrous ammonia.
(2) Propane for hydrogen.

c. Chemicals:
(1) Sulphuric acid.
(2) Sulphur—from zinc reduction.
(3) Ammonium sulphate—fertilizer.
(4) Caustic soda and chlorine.
(5) Soda ash.
(6) Saltern—solar and fuel (coal and electricity).
(7) Calcium carbide (electric furnace method).

d. Ceramics and Glass:
(1) Pottery.
(2) Tile.
(3) Brick, structural and refractory.
(4) Glass, flat and shaped.

e. Soapstone:
(1) Oven ware, bric-a-brac.

4. In addition to the above, which are based on indigenous materials, possibilities should be considered for such industries as:

a. Steel Re-Rolling Mill:
(1) Electric furnace for remelt of scrap for castings and billets.
(2) Open hearth for scrap and pig iron operation.
(3) Rolling mill for production of reinforcing bars, mechanical steels (rounds, bars, flats and wire for nails and screw machine products), and light structural shapes.

b. Steel Fabricating Plants:
(1) Nails, screws, bolts, nuts and rivets.
(2) Small plate shop for tanks, bins and other plate products.

c. Assembly Plant for Home Radio Receivers:
(1) Dry cell production.

d. Jute Bag and Sack Mill.

Obviously, many of the industrial projects which have been listed above as possibilities, in view of Burma's material resources, may not prove to be practicable upon critical examination. Nevertheless, their variety and range strongly suggest the possibility of considerable industrial expansion.

D. MODERNIZATION AND EXPANSION OF EXISTING ENTERPRISES.

A nucleus of industry exists in Burma today. A considerable degree of industrial expansion and development could be achieved if existing businesses were to modernize and expand their productive plant, and improve their production methods. Individuals and firms have learned considerable about the fields in which they are engaged—about raw materials and suppliers, production methods, markets, and so on. This accumulated knowledge should be utilized to the maximum extent possible, except where public policy for good and sufficient reason indicates other courses of action. This preliminary report will therefore suggest the creation of a mechanism through which existing enterprise will be able to obtain financial assistance toward the expansion and modernization of plant and equipment.

E. CRITERIA FOR THE SELECTION OF NEW INDUSTRIES.

1. Can the product be produced economically, i.e., at costs equal to or lower than the landed imported cost?
2. Will the product contribute to the nation's welfare, and is it sufficiently important to the nation's welfare to warrant priority treatment in a development program?
3. Will the product create adequate employment and increase in per capita output, for the capital investment required?
4. Will the new industry conserve the nation's foreign exchange?
3. Will the product create adequate employment and in related lines, i.e., will other industries develop in order to provide it with materials and supplies, to fabricate its product, etc.?
6. Will the new industry require more skilled workers and supervisors than it will be feasible to train in time?
7. Does the new industry fit in with other elements in the industrial expansion program?

The criteria suggested above are not exhaustive. Neither is it implied that before favorable decisions can be reached with respect to initiating a new industry, all the criteria stated above must be satisfied. However, every effort should be made in selecting new industries for development in Burma, to satisfy the criteria above to the maximum possible degree.

F. CONSIDERATION OF SPECIFIC PROJECTS.

Preliminary consideration of the possible avenues of industrial development in Burma, taking into account the indigenous material resources, the studies and plans already made by the Government, the needs of the economy, and the criteria for selection outlined above, suggest that initial attention and study should be given to the projects below. However, in the short time which has been available, it has not been possible to canvass thoroughly the field of possible industrial development. As the work of the survey group continues, additional and perhaps more promising projects will require attention.

1. Improvement of the rice milling facilities.
2. Fishing

3. Salt
4. Bamboo pulp and paper.
5. Re-rolling mill for scrap.
6. Brick and roof tile.
7. Groundnut.
8. Rubber
9. Cement.
10. Glass—flat and shaped.
11. Cigarettes.
12. Ceramics
13. Soap.
14. Sugar mills—raw and refined.
15. Mills for structural lumber and millwork.
16. Caustic soda and chlorine.
17. Sulphuric acid.
18. Bottling.
19. Fertilizer.
20. Jute bags and sacks.
21. Cottage industries.

It has not been possible to analyze all these projects in this Preliminary Report. The analyses presented in the case of some are relatively detailed; in the case of others, much more analysis is necessary. Where warranted, the consideration of projects will go beyond the question of feasibility, and explore questions of design, erection and operation as well.

The above listed projects are discussed in the following section.

1. IMPROVEMENT OF RICE MILLING FACILITIES.

a. Rice is Burma's most valuable resource and a domestic food staple and source of foreign exchange. Before the war, the average outturn was over 5 million tons, of which about 3 million tons were exported. For the 1950-1951 season the total outturn was about 4 million tons of which about 1¼ million tons was exported. A large part of this decrease is due to unsettled conditions in some producing areas but some is attributable to a degradation of grain quality and to breakage in the milling operation. This condition has also resulted in increased domestic consumer prices for rice without an undue proportion of breakage. If the present world rice shortage should ease, the continued production of substandard grain probably would seriously jeopardize Burma's competitive export position.

b. There are two principal approaches to a solution of the breakage problem. The first approach is to improve the variety of paddy grown. Work on this phase has not been pursued actively since the war. This is an agricultural problem. The second approach is to improve the milling operation by the use of up-to-date techniques and improved machinery.

c. A detailed report has been submitted to the State Agricultural Marketing Board by the U.S. Special Technical and Economic Mission offering recommendations which if implemented should result in a substantial decrease in breakage during milling operations. Because of their importance, the salient recommendations of that report are repeated here:

> "(1) An American rice milling engineer should be employed for a period of not less than a year and one half to direct the installation and operation of both the German and American mills and be responsible for *their* acceptance on behalf of the Burmese Government. To also help train personnel in the design and operation of both the European and American mills and aid in the development of plans to modernize the existing mills in Burma.
>
> (2) It is *strongly* recommended that the S.A.M.B. staff being employed to carry out this modernization program be sent to study techniques in the United States concerned with design, manufacturing, growth, milling, etc. This staff should consist of men who would specialize in such things as—
>
> (a) Rice milling engineer (2)—6 months during which some time will be spent in visiting rice mills and parboiling facilities and approximately 3 months studying mill design, assembly, and fabrication in such companies as the Engleberg Huller Co. (already advised they would be willing to cooperate with this).
>
> (b) Grain specialist (1)—6 months to 1 year study methods of improving varieties, grain selection, disease, insect, crab or shrimp control, fumigation, etc.
>
> (c) Grain storage and material handling specialists (1)—3 to 6 months to visit storage facilities, dryers, mills, etc. and study material handling techniques employed in modern installations.
>
> (4) An incentive program must be offered to the millers so that modernization will mean more income.
>
> (5) Improvement of rice varieties by seed selection programs and reactivating the experimental stations as soon as possible."

d. Serious consideration should be given to these recommendations, especially to that made in paragraph (4). The bulk of the rice is purchased under a specification that allows a 42 per cent breakage. The same price however prevails for an outturn containing less breakage, thereby eliminating any incentive on the part of the miller for improvement of product beyond that point. A sliding scale of prices that would be inversely proportional to the degree of breakage would provide a real impetus to the recommended program.

Rice milling will undoubtedly remain one of the outstanding industrial occupations in Burma. It is geographically dispersed widely through the country. The modernization of Burma's rice milling facilities is warranted on a priority basis to improve the quality and value of output and to build a sound foundation for Burma's export surplus in the future.

e. Recommendations. It seems clear that the modernization program desired can be stimulated by (1) providing rice millers with a real incentive, in terms of premium prices, to reduce rice breakage and to improve the quality of output and (2) building a new rice mill, which will be the latest word in design, equipment and operating procedures, and which will serve as a model to the entire industry.

2. FISHING.

a. Fish constitutes one of the most important items in the diet of the Burmese people. Department of Labor data indicate that about 30 per cent of the food budget of a typical Burmese family in Rangoon would be spent for fish and fish products. Yet, despite the natural advantages which Burma's economic geography provides in both fish-bearing inland waterways and lakes and in her salt water frontage, Burma has never been self-sufficient in fish production. She was a substantial importer of fish and fish products before the war, and is still importing on a substantial, though reduced, scale today, as is shown by the following figures:

	Production		*Imports*		*Exports*	
	Tons	*Rupees*	*Tons*	*Rupees*	*Tons*	*Rupees*
1936-1937	Not Available		12,676	60,95,076	312	1,87,630
1937-1938	Not Available		11,950	59,31,000	317	1,79,662
1938-1939	Not Available		10,200	52,20,000	692	1,92,386
1939-1940	Not Available		11,004	51,84,900	482	1,90,970
1940-1941	Not Available		8,262	47,36,472	1,101	4,55,652
Five Year Average						
1936-1941	Not Available		10,818	54,33,490	581	2,41,260
1948-1949	Not Available		3,200	63,27,000	Not Available	
1949-1950	Not Available		4,600	93,93,000	Not Available	

The above data clearly indicate the increased cost of fish. The average landed cost per ton in 1949-1950 was Rs. 2,080/- as against an average of Rs. 500/- for the five prewar years, or an increase in cost of about 400 per cent. This increase in the cost of a staple food item warrants serious consideration of ways and means of reducing it. Further, the data also show a decline in absolute imports the signficance of which is unclear in the absence of domestic production figures for the postwar years. The decline could mean a decreased consumption or increased domestic production.

b. Having the advantage of reportedly fertile fishing grounds off her shores, there is no apparent reason why Burma should not only be self sufficient but an exporter of fish in larger quantities than in the past. The estimated present domestic consumption of both salt and fresh water fish is 40 to 45 pounds per capita annually. As an interesting comparison, the annual per capita consumption in Japan is 75 pounds. In the case of Burma, a higher per capita consumption would raise the standard of living.

A substantial increase in domestic production would not only contribute to raising the living standard but would conserve foreign exchange for equipment and industrial raw materials and provide additional work opportunities as well.

c. Recommendations. In view of the apparent desirability and feasibility of a fishing industry, it is recommended that immediate consideration be given to the formation of a deep sea fishing organization whose production goal for the immediate future would be 20,000 tons of fish annually. This amount is about 15,000 tons more than imports in 1949-1950, but only some 7,000 tons larger than imports in 1937-1938.

This modest capacity is recommended for the following reasons:

(1) There are no figures available on domestic production of fish and therefore no estimate can be made at this time of the required supplementary production.

(2) A large catch would require considerable investment in storage processing and distribution facilities.

(3) The fishing industry is easily expandible to keep pace with a growing market.

For these reasons it is believed that the capacity indicated is optimum for the beginning of the industry. A capital investment of about Rs. 20 million would be required for boats, fishing gear, processing plants and other on-shore facilities.

3. SALT.

a. The demand for salt will substantially increase with the recovery and expansion of agriculture, fish and meat industries. It is also the basic raw material for the production of caustic soda and chlorine which in turn are converted into other chemicals that will be widely used in paper, glass, rubber and other industries projected for the industrial development program, implementation of which will further add to the demand. High cost imported or domestic salt could seriously retard or prevent the development of many potentially profitable domestic industries. Production, quantities and values for both exports and imports, for pre and postwar periods, are given below:

	Production	*Imports*		*Exports*	
	Tons	*Tons*	*Rupees*	*Tons*	*Rupees*
1936-1937	44,892	81,881	15,65,522	14	975
1937-1938	41,692	59,416	13,05,147	4	378
1938-1939	56,303	38,867	8,66,609	8	486
1939-1940	57,132	61,645	17,97,189	9	637
1940-1941	91,458	17,889	7,39,580	7	565
Five Year Average		51,940	12,54,809	8	608
1947-1948	45,533	189	67,916	NA	NA
1948-1949	30,846	Not Available	NA	NA	NA
1949-1950	52,715	NA	NA	NA	NA

The import table indicates an average prewar five year expenditure of about 1.25 million rupees for salt imports at a cost of about Rs. 25/ per ton. An increased demand without accelerated domestic production would obviously necessitate increased foreign exchange expenditure which may be possibly avoided.

b. At present the greater part of Burma's salt pro-

duction is largely from sea water extraction using outdated methods. Some salt is extracted from brine wells and springs in Upper Burma using the same means but no data are available as to quantity. There are no known rock salt deposits in Burma. The practical possibilities for increasing production apparently is the more intensive exploitation of known brine wells, springs and the sea by the application of modern, efficient extraction equipment and methods. Exploration of brine well and spring potentialities should be undertaken as salt concentrations usually occuring in such offers possibilities of more profitable extraction.

c. Recommendations. In order to increase the production of salt to eliminate imports and to provide for the projected increased use, early action is recommended in the interest of keeping pace with the proposed program of industrialization, on the following:

(1) Determination of the probable reserves of the existing brine wells and springs. Such information is required to establish justification for extraction plant at any or all of the known sites.

(2) Survey and exploration of possible new brine wells or springs in the event that reserves of existing ones do not justify investment in large scale production facilities.

(3) Procurement of preliminary designs of modern multiple effect evaporation plants to suit operating conditions at brine wells and springs and for possible integration into the most promising of the sea salterns. Close capital and production costs may be estimated from the designs.

Exploitation of coal resources as projected in Section VI would provide a source of fuel for saltern. In the further future, perhaps "off peak" hydro-electric energy offers possibilities for a low cost fuel substitute. No reasonable effort should be spared to insure Burma's self sufficiency in salt.

4. BAMBOO PULP AND PAPER MILL.

a. The Market

(1) Burma imports practically all of her paper and paper product requirements. The following table shows the imports for the period 1939-1940, which indicated the use of a general line of printing, writing and wrapping papers:

1939-40
Landed Cost

Classification		1939-40	1950-51 *Cost per Ton*
Packing and Wrapping Paper (all kinds)	Rs.	471,024	Rs. 2,700
	Cwt.	28,737	Czech. Kraft
Writing papers including envelopes and boxed stationery	Rs.	594,899	
	Cwt.	20,803	Rs. 2,470—3,160
Old Newspapers	Rs.	1,071,780	Rs. 800
	Cwt.	152,252	
White printing papers	Rs.	925,794	Rs. 2,600
	Cwt.	40,587	
TOTAL	Rs.	3,063,497	
	Cwt.	242,379	(12,118 tons)

(2) At the outset of an investigation of the feasibility of producing paper from bamboo, limitations as to the possible types and grades of paper which can be produced are automatically set due to the factors of present technologic advancement in the industry and the demand in the general economy. With these factors in mind, this section is predicated upon the possible production of three types of paper to supplant the four items of import indicated above.

(3) The old newspapers, indicated above, are largely used in wrapping. It is probable that an unbleached paper could be produced that would supplant this item, at a somewhat higher cost. A clean, unused wrapper would definitely be more desirable, especially for food items, than old newspapers even if it were more expensive.

(4) The production of newsprint from chemical pulp is too costly to compete with the imported groundwood product, present landed cost of which is Rs. 1,035 per ton. Bamboo does not lend itself to the grinding process necessary for the production of cheap newsprint. This problem could be studied as a future research and development project at Rangoon University or some industrial laboratory in Burma.

(5) The population of Burma in 1939-40 was about 16.5 million people; the per capita consumption of the four subject kinds of paper being 1.5 lbs. The estimated population for 1959 is about 20.5 million. On the basis of the 1959 population and the 1939-40 per capita consumption rate, consumption in 1959 would be about 31 million pounds or 14,000 tons. It is difficult to estimate with any degree of accuracy the increase in consumption caused by an increase in the standard of living which is expected as a result of the nation wide expansion program over a period of years. However, an increase of 15% seems a conservative estimate. Therefore, the expected 1959 consumption of the subject papers would be about 16,000 tons.

b. Possibility of Domestic Production

(1) The increasing consumption of pulp and paper throughout the world and the steady upward trend in prices has prompted nations dependent on imports to survey their indigenous sources of cellulose as a basis for a domestic pulp and paper industry. Burma is fortunate in having available sizable tracks of bamoo as such a source. Unlike the pulp woods of most countries, bamboo is fast growing and, to a degree, self-perpetuating. With an intelligent harvesting program related to the particular species of a given tract, a prime source of paper making raw material can be maintained. The bamboo areas which offer adequate sources of raw material are shown on the attached map. The information was furnished by the Conservator of Forests, Utilization Circle, GUB.

(2) The possibility of pulp and paper production in

Burma from bamboo has been for many years the subject of much discussion and several investigations; the most rigorous of which was reported by Riatt (The Burma Bamboo Pulp Survey; Calcutta; Government of India, Central Publication Branch, 1929). Tests were made (1929) which indicated that a satisfactory printing paper could be produced from Burmese bamboo. Further indication that production of some types of paper from bamboo is not only possible but profitable lies in the fact that there are now some 30 odd mills for the purpose in India and Pakistan, with more being projected for the future.

(3) In addition to raw bamboo, the other principal materials required are fuel, chemicals and water. Pulp and paper making is essentially a thermo- chemical process. In modern mills, a large proportion of the electric power demand is generated by steam, the exhaust being used for digesting and drying resulting in low cost power. The remaining portion may be purchased from an outside source or generated above that dictated by process steam demand.

(4) At the present time Burma's solid fuel requirements are supplied by imported Indian coal and locally produced wood. Liquid fuel requirements are furnished from the local refinery. Records indicate (see Section VI) known deposits of coal in Burma of a quality suitable for steam generation. Exploitation of these deposits for the support of not only a paper mill but for a general industrial development is mandatory for a long range operation.

(5) The chemicals required are those produced in commercial grade and in large quantities in many countries. For the initial phase of paper production in Burma, all of the requisite chemicals with the exception of lime would have to be imported. However, it is possible in the future to produce a large part of the chemicals in Burma contingent upon the development of low cost electric energy, salterns and certain ore processing operations.

(6) There are few persons in Burma at the present time with a real knowledge of the day to day operational procedures of pulp and paper making. There are several ways in which practical training in paper mill operation can be effected for all levels of personnel required. If other considerations indicate that a paper mill is feasible and a decision is reached to initiate design work, a personnel training program can begin simultaneously.

c. Economic Feasibility

(1) Cost of Mill Construction. On the basis of the projected 1959 consumption of 16,000 tons and an operating year of 290 days, 24 hours per day, the daily capacity of the plant for the purpose of this investigation will be taken as 55 long tons. While these may appear to be an oversimplified method of arriving at capacity, the figure will be used for two reasons; it is only about 12 per cent above the minimum competitive size of plant and the estimated cost of production will provide a basis of comparison for a future decision as to size.

The following figures are estimates and approximations for budget purposes only for the design and construction of a mill in Burma. They are based on current cost data from several sources in Asia and the United States and are not based upon final design:

		Rs. (1000)
General facilities (Piping, cranes, etc.)		710
Water Supply		1,620
Bamboo Preparation		590
Pulp Mill		
Digesters	437	
Washing	712	
Screening	618	
Recooling & Evaporation	1,425	
Causticizing & Reburning	712	
		3,900
Paper Mill		
Refining	830	
Paper Machine	3,800	
Finishing	420	
		5,050
Power		
Boilers & auxiliaries	1,425	
Turbines & switchgear	1,305	
		2,730
Bleach Plant		1,430
Maintenance Shops & Misc.		950
Buildings		2,140
Engineering & Drafting (5%)		950
Construction (Labor, construction, overhead, etc.)		7,100
Freight & Export packing		3,090
Contingencies		2,480
Total for Plant		32,740

To the above estimate, the cost of site, bamboo acreage, railroad sidings, access roads if required and the amount of working capital should be added. For the purpose of this report, the estimate of cost will be taken as Rs. 3.3 crores and the estimated production cost computed thereon. Apprixomately 80 per cent of the estimated amount would be spent abroad for equipment and engineering services.

(2) Cost of Materials. Cost of materials depends upon certain factors, one of which is location of processing plant with respect to point of supply. It is beyond the scope of this investigation to evaluate the available sites, however, for comparative purposes, the estimated cost of Arakan bamboo delivered to a nearby mill site is used. The approximate cost of bamboo delivered to sites in the vicinity of the following reserves are:

District	*Per ton of air dried bamboo Rs.**
Arakan	66/
Tenasserim	20/
Toungoo	21/

*Based on F.A.C. report with present day price adjustment by U Kwat Kaw, Forest Economist, Forestry Department, UBG.

On the basis of the subject mill capacity, the following are the annual requirements of the principal materials for a production of 16,000 tons of paper annually:

Raw Bamboo

The annual requirement for standing bamboo will be about 64,000 tons. Cost about Rs. 66/ per ton delivered air dried.

Lime

The annual requirement for the mill will be about 3,500 tons. In the vicinity of both Tenasserim and Arakan there are limestone deposits. No figures are available that will indicate production cost. The cost of imported lime is about Rs. 120/ per *ton.*

Glauber Salts

The annual requirement for this item is about 1,190 tons at an imported price of approximately Rs. 175/ per ton. A further investigation into the feasibility of production of this chemical from domestic sulphuric acid and salt (sodium chloride) will be made.

Caustic Soda

The annual requirement for this item is about 250 tons at an imported price of approximately Rs. 1,000/ per ton. A further investigation into the feasibility of the production of this item and chlorine from the electrolysis of brine will be made.

Chlorine—Liquid

The annual requirement for this item is about 1,300 tons at an imported price of Rs. 380/ per ton.

Clay

The annual requirement of pottery clay is about 1,000 tons at a domestic price of approximately Rs. 35/ per ton. Suitable clay is available in Burma.

Rosin

The annual requirement for the mill will be about 270 tons at an imported price of Rs. 3,000/ per ton. Investigation should be made as to the availability from an indigeneous source.

Soda Ash

The yearly consumption of this material is estimated to be 66 tons at the imported price of approximately Rs. 600/ per ton.

Alum

The requirement for this material which is used in sizing of paper will amount to 665 tons a year and will be imported at Rs. 284/ per ton.

It is assumed that the above materials will be imported until such time as some of them are produced domestically.

Fuel

It is estimated that about 30,000 lbs. of steam per ton of paper will be required in view of the prevailing climatic conditions. Roughly 5,000 lbs. of steam per ton of pulp can be obtained from the chemical recovery system. Modern paper mills obtain a large part of their electrical requirements by generation from the steam produced for process. The excess electrical demand may be obtained from outside source or obtained from its own generating facilities. The electrical demand is estimated at about 3,500 kw. For total process steam and electrical requirements, about 18,000 tons of 12,000 Btu. per lb. coal is needed. On the basis of imported Indian coal at Rs. 90/ per ton the annual cost will be Rs. 16,20,000. This cost can be diminished by the development of domestic resources.

The approximate cost of materials and fuel per ton of good grade printing paper is:

Item	*Rupees*
Bamboo	166.3
Glauber's Salt	17.4
Caustic soda	20.2
Lime	78.0
Chlorine	38.0
Rosin	60.2
Soda Ash	2.9
Alum	14.2
Methyl Violet	29.5
Clay	21.8
Fuel and Power	121.5
Total per ton	570.0

(3) Labor Cost. It is estimated that 30 lbs. of printing paper will be produced per man hour. For a daily output of 55 tons about 500 employees will be required, or about 165 per 8 hour shift other than managerial and general office staff. About half of a shift will be skilled workers. On this basis the direct labor cost per ton of paper will be about Rs. 40/ per ton.

(4) Cost of Production—All Costs. The following is an estimate of the cost of a ton of good grade printing paper at full mill capacity:

Operating Costs	*Rupees*
Materials (including fuel and power)	570.00
Labor	40.00
Administrative (executive, office, sales, etc.)	70.00
Fixed Costs Depreciation @ (10%)	210.00
	890.00

The estimated cost above is for 100 per cent operating capacity. At 75 per cent operating capacity this cost will be increased approximately 25 per cent or to about Rs. 1,100 per ton.

The Superintendent, Govèrnment Printing and Stationery, Burma, advises that for a comparable grade of paper for which the above cost was estimated, the cost f.o.b. U.K. ports was from 150 to 160 £ per ton during 1951. The landed cost includes a freight and insurance charge of 8 per cent, duty 20 per cent and clearing and incidental charges of 2½ per cent which is about Rs. 2,600 per ton. No paper of comparable grade is imported from India.

d. Recommendations. While the costs given in this report are necessarily approximations they indicate a definite possibility of production of the four types of paper on which the study was predicated and at a cost considerably lower than the import cost of all the subject grades except waste newspaper. It is, therefore, recommended that pre-

liminary designs be undertaken in order that more definite capital and operating costs can be determined. Equipment and machinery specifications are determined from the preliminary design.

The indicated capacity of 55 tons per day seems an optimum for conditions of the national economy likely to prevail for some years. Pulp and paper, particularly pulp, in excess of the domestic requirements should find a ready export market if of competitive quality.

The pine and decidious woods of Kayah State and Southern Shan States should be investigated as possible pulp and paper raw material

5. RE-ROLLING MILL FOR SCRAP.

a. The Market. Burma has had no facilities for the production of wrought steel products on an industrial basis in the past. Since steel goods occupy an important place in any progressive economy, an investigation of the possibility of producing at least some forms of steel is in order. The presence of an undetermined amount of scrap steel and iron in the country has aroused interest in ways and means of returning it to the economy in useful forms. In the absence of any known deposits of ore and coking coal which could support a basic steel industry, the products of a mill based on scrap resources should be of the small sizes and shapes in order that the capital investment in the plant would be in proportion to the available scrap tonnage.

Imports shown in Table I indicates a demand for light shapes, round and square bars. This discussion is limited to the possibility of producing only these light forms domestically and the table does not clearly indicate the imported quantity of these items. Trade sources have indicated the possibility of a widespread market for the smaller sizes if they were produced domestically.

The implementation of certain power and public works programs would engender a sizeable demand for reinforcing bars. The economic development program, as it progresses, will increase the demand for all types of iron and steel products.

b. Possibility of Domestic Production. The factors which contribute to the possibility and desirability of domestic production of light steel goods are:

An undetermined but presumably large amount of scrap steel and iron in Burma as a result of the war.
Export restrictions on Indian steel, the nearest source of supply, due to production limitations.
Information from trade sources indicates a ready domestic market for many types of steel products such as wire for nails and screws, bolt stock, rounds, flats, light structural shapes and reinforcing rods, among others.

The two principal methods for the reduction of scrap applicable to conditions in Burma: open hearth furnace fired with oil, or electric arc furnace with the billet heating furnace or "soaking pit" fired with oil. Each of the two methods has certain metallurgical advantages in the types of scrap which may be used and in the grade of steel produced. It is probable that for the overall economy of the operation, the arc furnace would be more suitable. In the event that iron ore extraction and reduction become economically possible in the future, open hearth production using pig iron and scrap may be feasible. In this connection, it is pointed out that there is no commercially practicable method of ore reduction by electric arc at the present time. Arc furnace operation obviously is contingent upon a low cost source of electricity, energy in the order of 500 kwhr per ton of production being required. An analysis of the desirability of a re-rolling mill should include an investigation of the revenue accruing from export sale either for cash or on a barter basis for finished steel. Prices for steel scrap are near an all-time high.

TABLE I
STEEL IMPORTS

Year	*Angle and Tee*		*Bars, other than Cast Steel*		*Ingots, Blooms, Billets and Slabs*		*Bars and Channels*		*Beams, Channels, Pillars, Girders and Bridgework*	
	Quantity Tons	Value Rs.	Quantity Tons	Value Rs.	Quantity Tons	Value Rs.	Quantity Tons	Value Rs.	Quantity Tons	Value Rs.
1936-37	501	67,164	6	686	8	1,136	41	4,962	2,456	534,804
1937-38	1,811	355,585	1,128	209,878	10	1,588	150	31,555	3,291	665,018
1938-39	2,054	350,486	356	69,004	53	12,638	52	10,001	2,807	599,892
1939-40	1,974	324,443	2,998	517,104	58	8,993	28	5,618	2,856	479,059
1940-41	2,050	402,755	2,220	441,234	18	5,490	467	137,968	973	224,188
Five Year Average	1,678	300,087	1,342	247,581	29	5,969	148	38,021	2,477	500,592
1946-47	64	22,820	3	1,662	—	—	5	6,848	4,979	5,264,164
1947-48	678	245,750	212	105,337	—	—	899	363,108	15,297	12,689,530
1948-49	Not Available	NA	NA	NA	NA	NA	NA	NA	NA	NA
1949-50	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Two Year Average	371	133,985	108	53,499	—	—	452	184,978	10,138	8,976,847

c. Economic Feasibility. The term "re-rolling" mill in connection with the subject operation appears in government publications and elsewhere. Strictly speaking, a re-rolling mill is one in which scrap of fairly large cross section and in long lengths is heated in a furnace and rolled to a smaller size. For instance, worn out rails are reduced in cross section to smaller rails or to reinforcing bars. A true re-rolling operation would require rather large pieces which may be a small proportion of the scrap in the country. The most advantageous type of operation for Burma, if the scrap collections in the Rangoon area may be taken as a representative sample, is one that would utilize most of the many kinds and sizes available. In other words, a complete mill with smelting facilities would appear to be required so that the product will have the maximum utilization value, as opposed to a re-rolling mill that would produce shapes and types of a limited use.

A budget estimate of the capital outlay required and an estimate of the operating cost for a suitable plant cannot be made until there is available a reasonably reliable estimate of the amount and type of scrap within a practicable hauling distance from the site. Published estimates and opinions gained from persons in the local trade all vary so widely that no conclusion can be reached at this time as to the desirability, feasibility and magnitude of the operation. Experience has indicated that scrap metal estimates made by the non-professional estimator are likely to be grossly in error, not only as to quantity, but as to grade. Probable cost estimates and methods of recovery likewise lie in the field of the professional.

d. Existing Plants. In the Rangoon area there are two re-rolling mills, one idle, and the other in the process of removal to another site. The idle plant is well constructed and laid out. However, the operational procedure is not efficient, entailing much handling. In addition, the type of scrap that can be used is restricted to certain forms of heavy plate or comparable pieces which form only a relatively minor proportion of a normal distribution of scrap. Further, the shape and size of product is limited to small round and square bars. The management is aware of the inadequacies of its process to the extent that it has had plans prepared by a Rangoon consultant for modernization, which would include installing two 40-ton-per-day electric furnaces and other equipment of greater productive capacity. At the time of the visit the plant was not operating, pending the arrival of a technician from India. The derth of skilled technicians is prevalent throughout the industrial system and is discussed in another part of this report. Despite the high cost of production in both these plants, demand for their produce was reported to be active.

e. Recommendations. As a first step in a critical examination of the project, a survey of the important scrap accumulations should be made by a professional estimator. An estimator from one of the large American or European scrap dealers who have had experience with battlefield clearance would be admirably suited for the job. Information from trade sources indicates sizeable quantities of crated machinery and parts in the Lashio and other areas. This material should be surveyed in detail to determine if any of it is usable in the economy as machinery instead of scrap.

If the scrap survey and other conditions warrant, consideration may be given to assisting existing producers to expand and modernize their operations. Such expanded plants may produce, among other items, reinforcing bars and light structural shapes for the transmission line towers and sub-station structures for some of the projected hydro-electric projects.

Until such time as hydro-electric energy is made available, negotiations might be initiated for a supply of lower-cost energy from the Rangoon thermal power station at "off-peak" hours, the operation of the plants being made to coincide.

6. BRICKS AND ROOF TILE.

a. The Market. Significant quantities of bricks, both structural and refractory, and roof tile are used in Burma. Evidence of a market for these essential building and refractory materials is indicated by a domestic production of 300,000 structural bricks in 1951 and imports of tile and firebricks as shown:

Years	*Imports*	
Brick, Ordinary	*Brick*	*Rupees*
1936-1937	48	64
1937-1938	12,728	8,859
1938-1939	8,082	1,377
1939-1940	2,410	360
1940-1941	7,650	1,681
Five Year Average	6,184	2,468
1947-1948	8,500	3,292
1948-1949	NA	NA
1949-1950	NA	NA
Brick, Firebrick		
1936-1937	496,912	83,612
1937-1938	847,340	143,412
1938-1939	869,130	143,277
1939-1940	1,189,880	209,794
1940-1941	611,815	154,874
Five Year Average	803,015	146,994
1947-1948	647,124	305,184
1948-1949	NA	NA
1949-1950	NA	NA
Roofing Tile		
1936-1937	2,350,244	215,295
1937-1938	2,534,942	211,224
1938-1939	1,864,000	146,265
1939-1940	2,439,394	188,495
1940-1941	2,916,216	228,235
Five Year Average	2,420,959	197,902
1947-1948	686,975	178,561
1948-1949	NA	NA
1949-1950	NA	NA

Exports of the above products were negligible. Imports of structural bricks are negligible. It is possible that they were face or other type of structural brick not manufactured locally and for which there is probably little demand. It is interesting to observe that roof tile was the largest import by volume, while firebrick imports accounted for the larger foreign exchange expenditure as indicated by the prewar five year average.

b. Feasibility of Domestic Production.

(1) Common structural brick. The absence of imports indicates that domestic production capacity has satisfied demands in the past. The industrial expansion program will undoubtedly demand increased numbers of structural brick but in the absence, at present, of data on the maximum output capacity of the existing producing facilities, their location and the reserves of their clay deposits, no recommendations can be made at this time. An investigation into production and markets will be made and the findings reported in the near future.

(2) Roof tile. At present none is manufactured domestically, the considerable demand being met by imports principally from India. Not only does the quantity of past imports warrant consideration of replacement by domestic production, but the probable increased use in the economic expansion program, together with the possibility that India may not be able to meet export demands due to her own building projects, are an added incentive for self sufficiency. Suitable clay deposits are located in several areas in Burma. It is understood the Government has proposals for the construction of a plant to produce 6,000,000 roofing tiles a year. This proposed production is about 2½ times greater than the maximum annual import of the five immediate prewar years.

(3) Refractory brick. This item is used, as indicated by imports, in significant quantities and entails the largest expenditure of foreign exchange. Boiler settings and furnace linings are its most common industrial use. The expansion program will also increase the demand for this item. It is reported that suitable clays exist in several areas.

Implementation of the following recommendation may insure a domestic supply of vital construction materials, release foreign exchange for necessary materials that cannot be produced locally and provide needed employment opportunities. Except for managerial and supervisory personnel, the larger part of the labor force would consist of unskilled workers.

c. Recommendations:

(1) Make a study of the market for roof tile, taking into consideration the probable increased use engendered by the expansion program.

(2) Review the Government's proposal for plant construction in light of the findings of the market study and study possible plant sites in relation to availability of clay, fuel and transportation of raw material and finished product.

(3) Investigate the reserves of clay suitable for refractory brick manufacturing, make a market survey of probable demand and if the findings indicate feasibility, prepare designs from which capital and production costs can be estimated.

7. GROUNDNUTS.

a. Groundnuts have been cultivated in Burma since before 1885. The extracted oil is used extensively by the Burmese family as a cooking fat. The greater percentage of the country's crop of groundnuts is used for the extraction of oil. The import table indicates that the annual outturn does not meet the domestic demand for groundnut oil. As a result of the continuing domestic crop deficiency, large annual expenditures of foreign exchange are made for imports of a product that may be produced domestically. The prewar five year average absolute foreign exchange was more than Rs. 2.2 million, the export value of groundnut cake for the same period averaged almost Rs. 2.5 million, and the imported oil averaged Rs. 4.7 million (See table below.) Vigorous action should be taken to conserve foreign exchange with which to purchase equipment and materials not produced domestically but which will be required for the implementation of the economic devolpment program.

Some domestic production, import and export figures are:

DOMESTIC GROUNDNUT PRODUCTION

PRODUCTION

Year	*Quantity in Tons*	*Value in Rupees*
1936-1937	Not Available	Not Available
1937-1938		
1938-1939	196,470	11,559,333
1939-1940	190,955	16,897,129
1940-1941	200,537	20,178,055
Five Year Average	195,987	16,211,506
1947-1948	153,499	49,797,357
1948-1949	NA	NA
1949-1950	NA	NA

IMPORTS

	Groundnut Oil		*Groundnut Seeds*	
Year	*Quanttiy in Tons*	*Value in Rupees*	*Quantity in Tons*	*Value in Rupees*
1936-1937	6,801	2,562,351	818	140,293
1937-1938	7,600	2,551,000	5,354	885,110
1938-1939	12,750	3,609,000	11,795	1,627,788
1939-1940	15,800	4,919,000	10,250	1,411,940
1940-1941	24,150	7,838,000	21,436	2,651,437
Five Year Average	17,550	4,729,250	9,931	1,343,314
1947-1948	1,050	1,778,000	57	8,580
1948-1949	6,400	13,370,000	NA	NA
1949-1950	14,200	29,548,000	NA	NA
Average	7,216	14,898,667		

EXPORTS

Year	Groundnut Cake Quantity in Tons	Groundnut Cake Value in Rupees	Groundnut Seeds Quantity in Tons	Groundnut Seeds Value in Rupees	Groundnut Oil Quantity in Tons	Groundnut Oil Value in Rupees
1936-1937	55,199	3,521,495	150	25,062	15	5,000
1937-1938	62,688	481,769	280	46,853	34	13,558
1938-1939	72,458	4,426,251	235	35,129	14	4,716
1939-1940	46,550	2,804,148	256	39,193	186	67,900
1940-1941	29,475	1,210,939	486	80,292	39	12,041
Five Year Average	53,274	2,488,920	281	45,306	68	24,554
1947-1948	23,615	5,564,726	—	—	—	—
1948-1949	NA	NA	NA	NA	NA	NA
1949-1950	NA	NA	NA	NA	NA	NA

b. There are some uses and conversions of groundnut oil and by-products of the extraction process, other than the conventional use of the oil for cooking and of the oil cake for animal feed that may find acceptance in the domestic market or provide export material. For instance, in consonance with the industrialization program an investigation should be made of consumer acceptance of solidified (hydrogenated) fats such as shortenings, cooking fats and oleomargarine. Some of these items may have export possibilities.

The projected expansion of the soap industry would require increased use of groundnut oil. Soap raw materials are now imported. The present imports of saponifiable vegetable oils could largely be replaced by groundout oil if produced at a competitive cost.

Other industrial uses for groundnut oil will undoubtedly occur as the economy expands as has been the case in other countries.

c. Undoubtedly, the present unrest has curtailed production of groundnuts. However, as has been pointed out, groundnuts and oil have been imported continuously since 1936. The reasons for dependency on imports are not readily apparent. Burma has enough available acreage of suitable soil which if cleared or developed would probably provide for self sufficiency.

d. Recommendations. It is recommended that this study be brought to the attention of the Agricultural Department with the view that they will undertake a program to promote an increase in the growing of groundnuts. It is further recommended that a detailed study of the uses of groundnut oil and of the methods of extraction be made to permit the formulation of a program for the improvement and expansion of this industry.

8. RUBBER PRODUCTS.

a. The Market. A promising market for rubber products exists in Burma. Imports of manufactured rubber goods were almost Rs. 5.5 million in 1940-41 and were somewhat in excess of this figure in 1947-48. In the latter year, the last for which detailed data are available, the chief rubber products imported were: 29,677 motor tires; 35,011 motor tire tubes; 138,419 bicycle tires; 162,633 bicycle tire tubes; 157,885 pairs of rubber footwear and miscellaneous items valued at Rs. 527,000.

The existing market for rubber manufacturers is certain to experience a considerable growth with the progress of the economic development program. This growth will occur primarily in the field of transportation but also in the fields of industry and consumer products. The domestic production of rubber manufactures would, therefore, serve to meet a growing demand, conserve valuable foreign exchange and utilize an important indigenous material. In the field of transportation there were some 21,000 non-military motor vehicles registered in all of Burma in 1951. A reasonable replacement allowance for these would probably be in the neighborhood of 40 to 50 thousand tires per year.

The key data on domestic raw rubber production, imports of manufactured goods and raw rubber exports are shown in the tabulation below.

	Raw Rubber Production		Manufactured Imports		Raw Rubber Exports	
	Tons	Rupees	Tons	Rupees	Tons	Rupees
1936-1937	Not Available		NA	15,49,579	9,292	69,88,453
1937-1938	Not Available		NA	19,79,000	9,317	69,19,000
1938-1939	9,900	NA	NA	17,26,000	9,428	59,58,000
1939-1940	10,470	NA	NA	24,82,238	9,971	50,11,000
1940-1941	13,339	NA	NA	54,68,491	12,703	96,13,000
Five Year Average	Not Available		NA	26,41,062	10,142	68,97,891
1947-1948	11,294	NA	NA	56,73,526	10,756	61,87,628
1948-1949	5,948	NA	NA	26,61,000	5,652	32,79,000
1949-1950	9,981	NA	NA	53,13,000	10,016	80,61,000

It is estimated that domestic production of a limited variety of manufactured goods such as rubber-soled canvas shoes, all-rubber shoes, rice mill blocks and toys absorb about 5 per cent of the raw rubber output.

b. Feasibility of Domestic Production. The production data for raw rubber cited above indicate that Burma has sufficient of the basic raw material required to supply a considerably expanded domestic consumption of rubber manufactures. Of the other raw materials required (carbon black, lithopone, sulphur, zinc oxide, caustic soda, and cotton, rayon or nylon yarns, etc.), some would have to be imported while plans for industrial development contemplate the domestic production of others. Although the manufacture of rubber goods is a technical operation requiring skilled management and supervision, the degree of skill required for the majority of labor is not great. The plant and equipment involved will depend so far as its complexity and costs are concerned on the volume of output which it is desired to obtain and the variety of production contemplated.

The tentative output targets for such a plant might be 40,000 automobile tires and tubes per year and 150,000 bicycle tires and tubes per year and to a much lesser extent rubber footwear and industrial rubber goods. The installation costs for such a plant and equipment is estimated on a tentative basis at 6 to 7 million rupees. Such a

plant should be able to manufacture the quantities of rubber products indicated on an economical and competitive basis.

c. Recommendations. On the basis of these preliminary findings, it is considered desirable to proceed with detailed studies and preliminary design on this promising industrial project.

9. CEMENT.

a. The only cement plant in Burma is located at Thayetmyo. It has a rated annual capacity of 60,000 tons. The production, import and export table shown below indicates that the plant supplied 90 to 94 per cent of the domestic consumption and exported from 12 to 25 per cent of its production from 1938 through 1941. The imports shown may have been, in part, types of cement not produced at the Thayetmyo plant.

CEMENT

	PRODUCTION	IMPORT		EXPORT	
Year	*Quantity (Tons)*	*Quantity (Tons)*	*Value (Rs.)*	*Quantity (Tons)*	*Value (Rs.)*
	Approximate				
1936-1937	12,000	33,459	1,329,612	—	—
1937-1938	56,500	20,674	873,408	—	—
1938-1939	71,568	8,328	352,896	18,298	674,620
1939-1940	62,896	3,725	156,103	7,437	204,662
1940-1941	69,432	2,725	116,426	7,399	200,830
Average for prewar years	65,100	8,863	374,708	11,045*	360,037*
1946-1947	Nil	24,001	2,220,620	Nil	Nil
1947-1948	Nil	39,131	4,255,368	Nil	Nil
1948-1949	5,527	NA	NA	Nil	Nil
1949-1950	Nil	NA	NA		
1950-1951	8,368				
Two Year Average 1951-1952	9,551	31,566	3,237,994		

*Three year average. NA = Not available

From 1942 through 1948 the plant was inoperable due to war damage. It was reopened on a reduced production basis during 1949 and was then closed. Since 1950 the plant has been operating at the capacities shown above, domestic consumption being largely supplied by imports.

b. The economic expansion program embracing construction projects such as dams, roads and buildings will heavily increase the demand for cement beyond present production capacity for some years. An estimate of the normal consumption of cement after the major projects have been completed would be difficult to make at this time, but it is reasonable to assume that a greater normal consumption than that of the prewar years will develop.

c. The overall capital cost of a new cement plant is affected by the source of equipment, by the plant's location and its access to raw materials including fuel and power and other factors. Recent Export-Import Bank data indicate a range of capital investment of Rs. 210 to 330 per ton of annual capacity. Production costs vary widely from plant to plant; however, roughly 60 per cent of the value of the products in the cement industry is direct labor and material cost. Lacking finite plant location, design capacity and other information, production costs cannot be estimated at this time.

Raw materials for cement manufacture, principally limestone having high lime content and clay are reported available near Myingyan and Moulmein. There are undoubtedly other areas where the materials are also available. Cost and availability of fuel and power have a large bearing on both capital and operating cost. The preferable fuels are gas, oil or pulverized coal. The sources of fuel in relation to the plant site have an important bearing on the production cost.

d. Recommendations. In order that sufficient cement be available for construction of the projects which are a part of the expansion program, it is recommended that as soon as requirements are estimated engineering studies be made to determine whether it would be more feasible to expand existing production facilities, build new ones or to import the heavy requirements of the expansion program. A market analysis of the probable future normal requirements should be part of the study.

10. GLASS—FLAT AND SHAPED.

a. In comparison with other consumer goods and construction materials there is little glass used in Burma. The table attached indicates the imports for a pre and postwar period. It will be noted that bottles form the larger part of imports both in value and in volume based on the prewar five year average. Figures on domestic production are not available but inspection of the production facilities in the Rangoon area indicate that they can supply only a small part of the demand for bottles and glassware.

The market potential for flat glass is not as promising as that for shaped products, principally bottles. The cost of flat glass is a limiting factor in domestic use and it appears that if the price could be substantially reduced, a larger market might develop. Some of the projects of the economic expansion program should stimulate the demand for both flat and shaped glass.

There are two plants in the Rangoon area engaged in the production of bottles, vases and miscellaneous items of glassware. Production is entirely manual and the furnaces and annealing ovens are an outmoded type. The production costs are probably high but in spite of process difficulties, the managements, who have considerable knowledge of glass making, succeed in keeping their plants operating.

b. Glass sands of several qualities are found in Burma. A deposit of iron-free sand is reported on one of the islands of the Mergui Archipelago the reserves of which are not known. There are several deposits of mainland sand of qualities suitable for making some types of glass

IMPORTS OF GLASS

Year	Bottles and Phails-Soda water bottles		Others		Funnels, globes and glass parts of lamps		Sheets and plates		Table ware (Including decanters, tumblers, etc.)	
	Quantity Gross	Value Rs.	Quantity Gross	Value Rs.	Quantity	Value Rs.	Quantity Cwt.	Value Rs.	Quantity	Value Rs.
1936-37	2,775	42,834	58,919	117,769	NA	88,014	23,259	166,070	—	113,136
37-38	5,238	77,912	89,583	146,564	NA	108.258	30,079	263,853	—	60,212
38-39	2,685	36,896	63,488	131,344	NA	108,197	17,244	145,472	—	54,000
39-40	3,449	53,937	81,099	164,865	NA	123,432	25,013	195,448	—	49,160
40-41	5,056	96,000	65,820	298,307	NA	122,399	16,819	227,757	—	36,427
Average for five years	3,841	61,516	71,782	171,770	NA	110,060	22,483	199,720	—	62,587
46-47	179	4,055	40,879	342,756	NA	201,836	13,123	517,136	—	331,913
47-48	590	15,257	39,349	437,425	NA	194,226	69,947	1,400,910	—	319,917
48-49	NA	NA	NA	NA	NA	NA	NA	NA		NA
49-50	NA	NA	NA	NA	NA	NA	NA	NA		NA
Average for two years	385	9,656	40,114	390,091		198,031	41,535	959,023		325,915

the reserves of which are not known. Some of these sands are used in one of the existing glass plants.

Fuel is an important raw material. The possible sources of fuel for a domestic industry are charcoal, produced on a commercial scale, imported coke or low cost electricity if available. Fuel oil and coal are not readily adaptable to glass making.

Lack of coking coal in Burma precludes domestic production of coke. A large part of the required chemicals could be produced domestically in the projected chemical plants. The chemicals used in present domestic production are imported.

c. The dairy industry and bottling industry discussed in this section, if implemented, would increase the demand for bottles. The implementation of the economic program in general would increase the demand for both flat and shaped glass. However, a market survey would be necessary before domestic glass production on an increased scale could be justified.

d. Recommendations. It is recommended that a detailed study be made of the market possibilities, sources of raw materials and the capital and production costs of flat and shaped glass manufacturing.

11. CIGARETTES.

a. Burma appears to have consumed about 500 million cigarettes in the year 1949-50. Of this total, approximately 90 per cent were imported, and 10 per cent domestically produced. Imports in 1949-50 were more than one-third below the level of 1937-38. There are no data readily available for comparing the present domestic production of cigarettes with that of the prewar years.

There are four plants producing cigarettes within Burma. One of these plants is known to use machines. At least one of the others is engaged in hand production. The operating procedure of the other two plants are unknown at this time. The local capacity may be double the actual local production. It is reasonably certain that operating costs in the local plants are comparatively high.

b. The importation of cigarettes requires a considerable annual expenditure of foreign exchange. In the year 1949-50 the total value of cigarettes imported was in excess of Rs. 40 lakhs. For the year 1951 import licenses were issued for the importation of cigarettes valued at Rs. 127 lakhs. Considerable savings in ıoreign exchange could therefore be effected by the development of domestic cigarette production, especially if domestically grown tobaccos were used.

Records indicate that prior to the war the average acreage of land devoted to tobacco raising was 130,000 with a production of 63 million pounds per year. In 1950-51 about 250 acres were devoted to the production of Virginia type tobacco with a total yield of about 200,000 pounds. Most of this tobacco was used in domestic cigarette production. The Department of Agriculture is very much interested in improving the quality of such tobacco and increasing the production. If this production can be increased so that quality cigarettes can be produced domestically, an enlarged cigarette industry would be possible.

c. At present, government revenue from taxes on the import and sale of tobacco is a relatively minor part of total revenues. The levies on imported tobacco are substantial and include an excise tax of Rs. 21/14 per thousand, plus a 40 per cent ad valorem duty. The excise tax on locally-produced cigarettes is only Rs. 2/8 per thousand. General experience in other countries demonstrates that cigarette consumption increases very substantially as the supply of quality cigarettes at a low price increases. Also, the demand increases as the general living standards and income of the people rises. The consumption of cigarettes in Turkey and Thailand, whose populations are about the same as Burma, is between 12 and

14 billion per year, as compared with about ½ billion a year in Burma. Increased production and consumption of tobacco products would result in increased revenues.

d. A modern, mechanized and efficient cigarette industry would conserve foreign exchange and provide increased employment and revenue. While the prospects for such a plant appear to be favorable, some questions require an answer before final decision. Among them are the prospects for more fully supplying locally-produced tobacco, and the probable market and the foreign exchange necessary for importing paper and tobacco pending an assured local supply.

e. Recommendations.

(1) That consideration be given to establishing a large scale cigarette industry and that supporting tobacco production possibilities be estimated.

(2) That a market survey be made to estimate probable consumption.

(3) That preliminary estimates of capital and production costs and plant layouts be obtained.

12. CERAMICS.

a. Unglazed pottery. Production of the widely used red clay water jugs, cooking and storage vessels made by many small local potteries is believed to be adequate for the demand. The simple equipment required, the abundance of clays found in many areas and the ease with which production facilities can be extended eliminate the necessity of a planned expansion program for this industry.

b. Glazed pottery. Domestic production of glazed clay products and values of imports and exports are shown below:

CLAY FOR POTTERY — PRODUCTION

Year	*Production*	
	Quantity (tons)	*Value (Rs.)*
1937	18,092	—
1938	18,066	—
1939	16,343	18,474
1940	N.A.	N.A.
1941	N.A.	N.A.
Prewar 3 yr. average	17,500	18,474
1946	8,906	40,475
1947	11,433	62,225
1948	2,095	37,864
1949	N.A.	N.A.
1950	N.A.	N.A.
Postwar 3 yr. average	7,478	46,855

EXPORTS OF EARTHENWARE & PORCELAIN

Year	*Value (Rs.)*
1936-37	304
1937-38	3,220
1938-39	2,692
1939-40	3,096
1940-41	2,781
Prewar 5 yr. average	2.419
1946-47	.....
1947-48	770

IMPORTS OF CLAY, EARTHEN-WARE, PIPES, SANITARY-WARE, PORCELAIN AND MISCELLANEOUS

Year	*Clay*	*Earthen-ware*	*Sanitary-ware*	*Porcelain & Miscella-neous*	*Total*
	Value (Rs.)	*Value (Rs.)*	*Value (Rs.)*	*Value (Rs.)*	*Value (Rs.)*
1936-1937	27,408	812	30,613	590,681	649,514
1937-1938	47,623	2,408	61,834	575,816	687,681
1938-1939	49,359	655	44,829	545,517	640,360
1939-1940	67,846	26,476	7,125	666,037	767,484
1940-1941	61,031	13,576	49,666	374,315	598,588
Prewar 5 yr. average	50,653	8,785	38,813	550,473	648,725
1946-1947	38,304	333	190,639	65,624	294,900
1947-1948	80,638	3,076	207,993	80,403	372,110
Postwar 2 yr. average	59,471	1,704	199,316	73,013	333,505

Lacking detailed identification of the items comprising the imports, it is difficult to estimate the products for which domestic production possibilities exist. A rough estimate is that perhaps 75 per cent of the products could be made in Burma.

Increased use of metal utensils may account for the decrease in production from 1935 to 1938. The low production in 1948-1950 has resulted from unrest prevailing in areas of supply and difficulties in distributing finished products.

c. All but a small part of the raw materials for a pottery industry are readily obtainable in Burma. Samples of indigenous clays, kaolin, quartz, feldspar, gypsum and other materials were examined at a pottery in Rangoon and found to be of good quality. Fuel requirements for large scale pottery production may be met by local coal if suitable kiln design can be worked out. Otherwise wood, fuel oil or imported coke would be necessary, the two former fuels are available locally.

d. A pottery works recently inspected in Rangoon was producing at less than one half of its normal capacity although it was stated that a market exists for four times the capacity of this plant. Present conditions of unrest in the country have curtailed output to the present level. Although the equipment in this plant is outdated and some of the equipment found in a modern pottery is lacking, nevertheless the finished products are of good quality. The management is able and has considerable technical knowledge of the pottery business. The management have plans for modernization but the unsettled conditions in the country have retarded their implementation.

e. The modernization of the pottery works discussed above would provide capacity to meet the domestic demand with a possible surplus for export. Time did not permit inspection of potteries in other parts of the country. However, the following recommendations are for the benefit of the entire industry.

(1) Make modernization capital available.

(2) Make available, where necessary, technical assistance.

13. SOAP.

a. As in most economies there is a general demand in Burma for toilet and laundry soaps. The demand is met by imports of high-grade toilet and laundry soap and domestic production of laundry and "all-purpose", i.e., toilet-laundry soaps of inferior quality. The import statistics for some prewar and postwar years are as follows:

SOAP IMPORTS

Year	Household and Laundry Soaps Quantity (cwt).	Value Rs.	Toilet Soap Quantity (Cwt.)	Value Rs.
1936-1937	1,047	18,658	1,496	115,135
1937-1938	64,392	1,294,146	3,494	273,227
1938-1939	70,213	1,327,072	3,097	260,486
1939-1940	94,666	1,752,531	4,684	332,125
1940-1941	87,156	1,701,152	4,228	340,985
Prewar Five Year Average	63,495	1,218,712	3,400	264,392
1946-1947	28,485	1,490,876	1,393	144,652
1947-1948	30,927	1,814,653	356	68,171
1948-1949				
1949-1950				
Postwar Yearly Average	29,956	1,652,765	875	106,412

The reason for the decline in imports since 1940-41 could be increased domestic production or less consumption. Data at hand are insufficient to reach a conclusion. It is of interest to note that while the postwar two year average import volume of laundry soap decreased to about 48 per cent of the prewar five year average, the cost per hundred weight increased nearly 290 per cent which is an incentive for possible domestic lower cost production.

b. Inasmuch as no domestic production figures are available at present, the import figures have little significance in relation to the probable total consumption as the predominant use is undoubtedly of the domestic product. Obviously, before any conclusions concerning the expansion of the soap industry can be reached, the basic market data such as present domestic production totals, production costs, retail prices, and the retail price at which increased acceptance could be expected must be examined.

c. Two existing conditions, however, warrant the further investigation of expansion possibilities. The first is the local production of several vegetable oils which can be used as basic raw materials for soap. The most important of these, perhaps, is groundnut oil, the current production of which is short of demand for it is an edible oil. A program to stimulate groundnut production, above that required as food, would be essential for a soap industry based on the use of indigenous raw material. The second favorable condition is that there exist facilities and technical abilities for the production of good quality soaps. Substandard soaps are now being produced in these facilities from imported materials. However, certain trade sources have indicated that with the introduction and enforcement by Government of quality standards the necessary sales and educational campaigns would be instituted by private enterprises to build a quantity market that would justify large scale, low cost production.

d. Recommendations.

(1) A study be made to determine the production costs of satisfactory grades of soap and consumer acceptance of these at fair retail prices. If the results of such investigation indicate the possibility of a large acceptance, action be taken to initiate such production.

(2) Study be made of the quality standards prevailing in other countries, with a view to the formulation and introduction of suitable quality standards in Burma.

(3) A program be developed to increase the production of readily saponifiable vegetable oils.

14. SUGAR MILLS—RAW AND REFINED

a. That refined sugar is consumed in Burma in significant quantities is indicated by the import data below:

Year	Tons	Value - Rs.
1936-1937	22,740	5,280,146
1937-1938	13,765	2,477,745
1938-1939	8,605	1,785,635
1939-1940	8,224	1,306,879
1940-1941	7,957	2,031,644
Average for Five Prewar Years	12,266	2,576,410
1946-1947	11	11,282
1947-1948	3,001	1,365,179
1948-1949	Figures not available	

In addition to imports, white sugar was produced by a domestic refinery. While substantiating production figures are not available, it is possible that the decline in imports was due to the increasing output of this plant. As there has been no domestic production of white sugar since the war, due to mill damage, imports for 1946-1947 and 1947-1948 probably have little relation to the potential market that could be developed if refined sugar could be produced domestically at a price that would permit wider use.

b. Before and since the war, an unrefined sugar product known as jaggery has been produced locally, usually by farmers. This product is made by boiling the cane juice to a thick concentrate, after which it is poured into molds and cooled. Jaggery is largely used as a sweet meat and does not have a widespread use as a sweetener for food and beverages. Since it is principally a cottage or farm operation, no reliable production figures are available. Both jaggery and palmyra, another form of crude sugar obtained from palm trees, are exported as indicated:

EXPORTS OF MOLASSES INCLUDING PALMYRA AND JAGGERY

Year	*Tons*	*Rupees*
1936-1937	13	2,640
1937-1938	52	4,969
1938-1939	2,993	334,512
1939-1940	2,143	303,985
1940-1941	525	100,010
Average for Five Prewar Years	1,145	149,223
1946-1947	NA	NA
1947-1948	1,546	135,492

It is understood that the exports are used in other countries as sweetmeats.

c. Sugar cane is indigenous to Burma, where, in several areas, a suitable combination of soil, rainfall and length of growing season are found. The attached map indicates existing centers of cane cultivation, the areas shown being those under cultivation together with areas of possible expansion. In 1931-32 there were some 17,600 acres under cultivation, in 1948 some 18,000. A Department of Agriculture report (No. 28 of 1933) states: "The area of (cane) cultivation under the stimulus of increased prices is capable of very considerable extension especially in the central parts". This same report indicates the possibility of 70,000 acres being put to cane cultivation. On the basis of a minimum yield of 12 tons per acre, the annual harvest would be 840,000 tons which in turn would yield approximately 84,000 tons of raw sugar and jaggery.

Preliminary analysis indicates that plant, equipment and labor costs in sugar refineries would be economic and feasible. The chief question which remains is what raw material costs for sugar cane would be, if cultivation were increased to 70,000 acres.

d. Recommendations. On the basis of the foregoing, it is recommended that:

(1) Analysis be made of the current feasibility of increasing sugar cane acreage to 70,000; the time required for such a program; and the probable cost of the output therefrom. On the basis of this information, a determination of the feasibility of a sugar refinery mill can be made.

(2) Cost estimate of rehabilitation and modernization of existing raw and refined sugar mills be made and possibility of combined operation by private and governmental interests be considered.

(3) Formulation of a sale price schedule for cultivators which should include a minimum price and a premium scale according to extractable sugar content of the cane be considered.

15. MILLS FOR STRUCTURAL LUMBER AND MILLWORK.

a. Burma's forests constitute one of her most important natural resources. The timber therefrom is used extensively domestically for structural purposes and the manufacture of furniture. Timber exports are an important earner of foreign exchange as indicated by the table below:

Year	*Imports - Wood*		*Exports - Wood*		*Manufactures Imports - Wood*	
	Cubic Tons	*Rupees*	*Cubic Tons*	*Rupees*	*Rupees*	
1936-1937	400	28,011	246,403	3,50,02,606	1,87,878	Incomplete
1937-1938	2,036	161,689	266,000	3,79,97,000	2,99,254	
1938-1939	2,628	110,794	251,000	3,33,02,000	2,64,391	
1939-1940	2,000	86,560	262,000	3,42,14,000	2,96,117	
1940-1941	2,344	122,956	246,000	3,22,95,000	3,23,357	
Five Year Average 1936-1941	1,882	102,002	254,281	3,45,62,121	2,74,200	Incomplete
1948-1949	Not Available		87,000	4,62,78,000	Not Available	
1949-1950	Not Available		19,000	1,30,32,000	Not Available	

The imports of wood are minor, consisting largely of soft woods for matches and other purposes for which indigenous woods are not suited. Production figures for the total timber cut or the cut by kinds are not available.

b. The processing of timber in Burma has been confined to sawmilling of structural timber and lumber for furniture manufacturing. Reports indicate that about 55 per cent of the timber cut is used domestically principally for housing.

At the end of 1949 there were about 160 sawmills operating with an annual capacity of about 560,000 tons and about 1,000 sawpits with 100,000 tons capacity. Both mills and pits are said to employ about 15,000 men. Of the existing sawmills the State Timber Board owns two large ones and contemplates the erection of three additional for processing teak.

c. Development of the economic expansion program will increase the demand for structural timber through implementation of housing, hospital, school and other public works projects. It has been estimated that at the present 50 per cent of the country's houses are of bamboo construction, 35 per cent mixed timber and bamboo, 14 per cent all timber houses and only 1 per cent brick or concrete. The percentage of timber houses in a housing program will undoubtedly increase; the desirability of this type of structure over bamboo construction being obvious.

The use of timber in boat, barge and other vessels should also increase as the expansion program develops.

At the present, the use of lumber for furniture absorbs but a small part of timber production as the low income level precludes its widespread use. As the general standard of living is raised, the demand for wooden furniture will rise which would stimulate that branch of the woodworking industry.

d. Apparently there are few "millwork" items, i.e., doors, door frames, sash and window frames, moldings, etc., on the market. In the interest of lowering the cost

of this material, the use of which will be augmented by projected housing schemes, consideration should be given to the production of standardized types and sizes. This practice in other countries has done much toward making home ownership possible for lower level income groups. The standardization of types of houses with regard to the structural wood framing also lowers the cost.

e. The projected increase in structural timber should stimulate an investigation of the possibilities of using woods other than teak which should be conserved as an earner of foreign exchange in the export market. There are possibly other hardwoods which are adaptable as structural timber. The softwood of the hill regions might be also adapted to structural use.

f. Recommendations.

(1) The Government's proposal to erect three teak sawmills should be reexamined for the purpose of processing woods other than teak.

(2) Standardization of millwork should be studied and production equipment therefor be integrated with the proposed sawmills.

(3) Study of mill wastes conversion to items such as chip board, dyes and other chemicals.

(4) Investigate other hard and soft woods for use as merchantable lumber.

16. CAUSTIC SODA AND CHLORINE.

a. Caustic soda is one of the basic chemicals required in an industrial economy. At present, Burma depends on imports for its limited consumption, the quantities of which are shown in the table:

IMPORTS OF CAUSTIC SODA

Year	*Quantity (cwt.)*	*Value (Rs.)*
1936-1937	19,683	192,467
1937-1938	24,183	220,837
1938-1939	23,211	217,786
1939-1940	39,732	459,492
1940-1941	35,243	342,646
Prewar Five Year Average	28,410	286,646
1946-1947	9,091	125,103
1947-1948	22,019	769,063
1948-1949	NA	NA
1949-1950	15,550	497,083

IMPORTS OF CHLORINE

Year	*Quantity (cwt.)*	*Value (Rs.)*
1936-1937	Nil	Nil
1937-1938	516	21,099
1938-1939	613	25,713
1939-1940	397	17,768
1940-1941	335	13,159
Prewar Five Year Average	465	19,435
1946-1947	191	8,392
1947-1948	388	29,386
1948-1949	NA	NA
1949-1950	NA	NA
Postwar Two Year Average	289	18,889

In the electrolytic production of caustic soda, the process on which this discussion is based, chlorine is simultaneously evolved. The imports of this widely used chemical are also shown above.

b. The imports of caustic soda in the past have little relation to the amounts that will be required by some of the industries proposed in the expansion program. As an example, the proposed pulp and paper mill alone will require some 1,500 tons annually. Increase in domestic soap production will require caustic soda in amounts in excess of present imports. Caustic soda is the basic material used in the manufacture of other chemicals which will be required by some of the projected activities in the industrialization program. Also, increased usage of chlorine will develop for water purification, sewage treatment and in the preparation of bleaching compounds and other chemicals required by industry.

c. The manufacture of caustic soda by electrolysis is a relatively simple process. Salt or brine is the only raw material required and, of course, power. The production of salt for this purpose was outlined in paragraph 3 of this section. Pending availability of hydro-power, electricity could be obtained from thermal resources.

d. Recommendations. It is recommended that serious consideration be given to the possibility of domestic production of caustic soda and chlorine and that an engineering study be prepared to determine capital and operating costs.

17. SULPHURIC ACID.

This product is so widely used in industrial processes that in some economies it is regarded as one of the best indices of industrial activity. The average annual postwar and prewar imports of this important chemical was about 250 tons. Requirements of this magnitude evidence a limited commercial use.

The implementation of the industrial expansion program will undoubtedly increase its use far beyond that indicated by past or present imports. For example, should future investigations justify the large scale production of ammonium sulphate fertilizer, a low cost source of sulphuric acid would be a requisite. In addition to that use, earlier implementation of such projects as a pulp and paper mill and the necessary attendant chemical manufacturing plants would also require low cost acid.

The production of sulphuric acid as a by-product of a zinc reduction plant has been mentioned under the Myingyan Project in Section VI. During the detailed studies for this plant, consideration will be given to the recovery of elemental sulphur and sulphur dioxide, the basic materials for the manufacture of sulphuric acid.

18. BOTTLING.

a. The production of bottled soft drinks at the present

is confined to small scale operations carried on largely without benefit of automatic machinery and, in some cases under questionable sanitary conditions. Production figures are not available but the presence in Rangoon of many retail soft drink establishments is evidence that there is a demand for the several types of beverages classified as soft drinks. This type of drink has found wide acceptance throughout the world, particularly in warm climates, where it is used largely as a quick, cool refresher. It is reasonable to believe that if advertisement and widespread distribution were established, the acceptance would increase. Increased production of the item would create a larger demand for sugar and bottles, which are the two costliest production components and which it is proposed to produce domestically.

b. The composition of the usual soft drink is simple, consisting largely of sugar syrup, carbonated water, flavoring and coloring. In many instances, the bottle, cap, and label account for the greater part of production cost. The bottle demand could be met by the glass plant proposed as a project in the expansion program. For practical purposes, the sugar syrup can be assumed to represent the remainder of the production cost. The syrup could be produced locally if the expansion of the sugar industry is realized.

The rather simple production process and the projected availability of the principal materials required evidence the feasibility of the proposed operation. The desirability should be determined by a market survey. A logical guide would be the production of the existing industry.

While the soft drink industry is not basic in the economy, its product if produced cheaply enough would provide a semi-luxury item that would be within the reach of many in the population.

c. It is recommended that:

(1) An investigation be made to determine possible consumer acceptance of soft drinks.

(2) Consider incentives to private enterprise toward the establishment of a soft drink industry.

19. FERTILIZER.

a. The need for fertilizing paddy lands has long been a subject of investigation. One of the most conclusive series of investigations was begun at the Hmawbi Experimental Station in 1913 and continued for fifteen years. Among the most important facts ascertained by the investigation were:

(1) The main requirement of the paddy soils was nitrogen in the form of ammonia and phosphate.

(2) That nitrogen in the form of nitrate is distinctly harmful. Although these experiments were concluded in 1928, more recent observations reach the same conclusions. It is reasonable to assume that the same, if not increased, soil deficiencies obtain at the present. In an essentially agricultural economy maintenance of crop yield is of prime importance.

b. To maintain the standard of fertility at its present level or to increase crop yields of all kinds of produce, the application of fertilizers has long been advocated by agricultural authorities. Indigenous fertilizers such as cattle dung, fish waste, bone meal, rice bran, cotton cake, green manure crops, etc.., are used but the quantities obtainable are inadequate for the purpose of bringing about marked increases in fertility. The use of imported artificial fertilizers in the past has fluctuated with the price of paddy. Some pre and postwar imports of fertilizer are shown below:

FERTILIZERS

	Import		*Export*	
	Quantity (Tons)	*Value (Rs.)*	*Quantity (Tons)*	*Value (Rs.)*
1936-1937	1,189	1,14,763	2,941	1,72,279
1937-1938	1,673	1,93,982	1,721	95,448
1938-1939	758	95,197	2,234	1,17,744
1939-1940	1,395	1,86,040	1,656	76,732
1940-1941	1,720	3,33,003	561	24,610
Prewar Five Year Average	1,347	1,84,599	1,823	97,363
1946-1947	40	11,590	3,566	6,63,523
1947-1948	241	78,918	3,538	11,73,785
1948-1949	278	84,794	—	—
1949-1950	14	5,751	74	18,978
1950-1951	348	1,15,621	—	—
Postwar Five Year Average	184	59,335	2,393*	6,18,762*

* 3-year average.

c. The necessity for a domestic source of fertilizer to Burma whose economic welfare is largely dependent on agriculture is a consideration of major importance. It is beyond the scope of this preliminary discussion to indicate conclusively the type of fertilizer that would be most suitable for rice and other crops. However, with the hydro-electric potential discussed in Section XI available, serious consideration should be given to domestic facilities for the production of fertilizers. This would be a large scale operation, complex in nature, and would require a large capital investment.

d. Recommendations. A preliminary investigation be made to include the following:

(1) Determine type of fertilizer most needed and the annual requirement. This determination lies in the province of the agriculturist.

(2) Make study of availability and cost of raw materials.

(3) Obtain preliminary design of plant, estimates of power requirement and capital cost of plant and power facilities.

(4) Make tentative selection of site based on power availability and cost, transportation cost of raw materials and finished product.

20. JUTE BAGS AND SACKS.

a. Jute bags, sacks and woven jute fabric constitute

one of Burma's principal imports and is used largely for bagging rice. The imports are of two kinds; bags and sacks which are imported in finished form and jute fabric which is made into bags and sacks locally. No jute fabric is produced, nor is any jute fibre grown in Burma on an industrial scale. The statistics below indicate the imported volumes and values:

IMPORTS OF BAGS AND SACKS

BAGS AND SACKS FOR PACKING

Year	*Quantity (No.)*	*Value (Rs.)*
1936-1937	Not Available	Not Available
1937-1938	52,459,000	11,971,000
1938-1939	59,218,000	13,316,000
1939-1940	52,162,000	18,018,000
1940-1941	52,363,000	17,707,000
Prewar Four Year Average	54,050,000	15,253,000
1946-1947*	5,110,000	6,896,000
1947-1948	20,629,000	13,898,000
1948-1949	3,548,000	6,781,000
1949-1950	9,691,000	7,032,000
Postwar Four Year Average	9,744,000	8,652,000

* Figures relate to private trade only.

JUTE MANUFACTURED IMPORTS

CANVAS

	Quantity (Yards)	*Value (Rs.)*
1936-1937	100	284
1937-1938	679,394	173,717
1938-1939	579,311	158,833
1939-1940	523,123	215,384
1940-1941	584,491	324,302
Prewar Five Year Average	473,284	174,504
1946-1947	248,940	276,987
1947-1948	4	20
1948-1949	Not Available	NA
1949-1950	NA	NA
Postwar Two Year Average	124,472	138,504

GUNNY CLOTH

	Quantity (Yards)	*Value (Rs.)*
1936-1937	2,356,272	250,505
1937-1938	2,168,918	222,504
1938-1939	2,067,658	195,684
1939-1940	1,102,894	167,678
1940-1941	1,638,462	284,376
Prewar Five Year Average	1,866,841	224,149
1946-1947	96,430	46,219
1947-1948	305,640	141,270
1948-1949	NA	NA
1949-1950	NA	NA
Postwar Two Year Average	201,035	93,744

OTHER KINDS

	Quantity (Yards)	*Value (Rs.)*
1936-1937	—	204,941
1937-1938	2,895	84,216
1938-1939	2,336	70,881
1939-1940	848	31,484
1940-1941	524	25,958
Prewar Five Year Average	1,651	83,496
1946-1947	1,145	143,986
1947-1948	132	26,938
1948-1949	NA	NA
1949-1950	NA	NA
Postwar Two Year Average	639	85,462

The prewar foreign exchange expenditure for these items warrant investigation of ways and means of reduction of imports.

If jute can be grown in Burma, on an industrial scale, a raw material would be made available for a new industry whose products would supplant imports and that would offer both agricultural and industrial employment opportunities for the growing labor force.

Consideration should be given to the possibilities of other fibres suitable for bag manufacture. The World Bank recently recommended the establishment of a bag mill in Cuba using kenaf together with imported jute. Recently there has been discussion of the possibilities of using kenaf, which has been grown experimentally in a sub-tropical portion of the United States, for bag making to diminish the dependency on imported jute materials. The possibility of domestic processing of imported jute would lessen foreign exchange expenditures and open avenues of employment.

b. Recommendations.

(1) Investigation of adaptability of jute to climatic and soil conditions and available growing acreage be made.

(2) Investigation of possibility of growing kenaf or other suitable fibre as a replacement for jute be carried through.

(3) Economic study based on preliminary design be made of feasibility of bag production from imported fibre. This project should be undertaken pending development of jute or other suitable fibe crop.

21. COTTAGE INDUSTRIES.

Cottage industries play an important part in industrial production in Burma today. Among the more important occupations are silk and cotton weaving, cotton spinning, cotton ginning, tailoring, and the manufacture of tobacco products, farm equipment, and mats. Production is carried on in small scale units with hired employees, and also in homes with only family members participating in the production process. In the case of home manufacture, it appears that production is frequently a part-time or seasonal operation which reaches its peak during the agricultural off-season. Statistics gathered by the Superintendent of Cottage Industries indicate some 5,000 separate production units and some 250,000 employees engaged in 38 cottage industries.

Government policy in Burma is to encourage and foster the development of cottage industries. In implementation, funds have been appropriated, a special department has been set up in the Directorate of Industry under a Superintendent of Cottage Industries, loans have been extended, United Nations Technical Assistance has been enlisted, demonstrators have been sent out into the field, schools have been set up, and protective tariffs introduced. The purposes behind this policy of assistance

seem to have been: a. to encourage domestic output; b. to provide agriculturists with a means of supplementing their income during the off-season; c. to conserve foreign exchange; and d, to stimulate employment and productive activity. The following table shows the cottage industries and the number of persons engaged:

COTTAGE INDUSTRIES IN BURMA

	Industry or Trade	*Number of Units*	*Number of Employees*
1.	Silk and cotton weaving	795	76,941
2.	Cotton spinning	750	58,744
3.	Cotton ginning	11	43,706
4.	Pottery manufacture	284	6,185
5.	Leather industry goods	127	309
6.	Gold, smithy	199	3,853
7.	Silver smithy	95	788
8.	Brass and bronze smithy	52	1,039
9.	Lacquerware manufacture	30	2,105
10.	Furniture making	17	2,360
11.	Manufacture of bamboo (hats, mats, etc.)	95	8,864
12.	Thin mat manufacture	89	11,089
13.	Burmese cheroots	326	9,634
14.	Tailoring	514	12,101
15.	Blacksmiths	86	3,478
16.	Bullock cart makers	221	901
17.	Agricultural implement makers	81	11,846
18.	Mechanical lighters	54	283
19.	Food industries	308	959
20.	Burmese toys	49	47
21.	Cane ware	164	224
22.	Bakeries	85	245
23.	Burmese cigars	97	3,050
24.	Pith hat manufacture	20	256
25.	Lapidiary	2	2,141
26.	Smoking pipes	—	263
27.	Parasol manufacture	150	4
28.	Soap manufacture	17	11
29.	Toilet goods manufacture	—	60
30.	Aluminum utensils makers	4	52
31.	Wood carving	48	39
32.	Ivory carving	34	6
33.	Safety matches	—	530
34.	Confectioneries	34	66
35.	Paper making by hand	15	—
36.	Leather tanning	32	50
37.	Carpentry	1	25
38.	Artists	—	1
	TOTAL	4,896	262,255

Source: U Tun Thein, Superintendent of Cottage Industries. January 23, 1952.

Note: The number of production "units" and the number of employees shown in this table are additive. The employees are not engaged in the "units" shown but are in other establishments.

Time has not sufficed to permit an intensive study or consideration of the problems of cottage industry. Consequently, no suggestions or recommendations will be offered with respect to them at this time. However, the following observations may help place the problem of the cottage industries in proper perspective.

a. Insofar as the drive for cottage industries arises out of inadequate farm income and part-time and seasonal unemployment, the economic development program should make a marked contribution to the problem by creating more productive employment opportunities throughout the economy. Also, increasing agricultural output and income should contribute towards a basic solution of the problem.

b. In considering ways and means of assisting cottage industry, the distinctions between home and handicraft industry, on the one hand, and small scale production on the other, should be kept in mind. Programs of assistance designed to help cottage industry should be geared to the somewhat different problems found in these different types of production organization.

G. PROPOSAL FOR A UNION OF BURMA INDUSTRIAL DEVELOPMENT CORPORATION.

1. If industrial development in Burma is to proceed rapidly, efficiently along the lines desired, some instrument must be created which will be adequate to undertake and carry through the job. Research, planning, technical know-how and capital in large amounts are all required for this task. No single existing government department or agency is adequate. Neither can the existing banking system be relied upon to handle it. To emphasize the great and urgent importance of the industrial development program, to bring together all the necessary means to carry such a program through, to fix clear responsibility for industrial development in one distinct and autonomous agency, the creation of a Union of Burma Industrial Development Corporation is recommended. The major features of the proposed organization are outlined below:

Objectives: To effect and assist the rapid, orderly and healthy development of Burmese industry, within the framework of the national plans and programs laid down by the government.

Ownership: The Government of Burma.

Capital: To be underwritten 100% by the government. Total capital to be computed.

2. Contemplated Activities: The activities of the UBIDC will extend to both existing and new plants and industries. These may be either private, public or combined ventures in nature. In broad, the functions of UBIDC would be to:

a. Engage in technological and market research to ascertain domestic industrial needs and opportunities, and research to improve production methods.
b. Assist in the expansion and modernization of existing industrial enterprises, where warranted, through capital participation, loans, technical and managerial advice, the improvement of measures and quality standard, market information, etc.
c. Initiate or assist in the organization and development of new enterprises, where warranted, through capital participation and loans. New enterprises may be public, private or combined ventures, depending on the circumstances in each case.
d. Sponsor training programs for administrators, man-

agers, industrial engineers, technicians and highly-skilled workers, so that the personnel needs of Burma's developing economy can be met.

3. INTERNAL ORGANIZATION. To permit the efficient execution of these activities, the UBIDC will require separate departments for: research and statistics, banking (loans and participations), personnel training, technical assistance and audits and controls, as well as a department for internal administration. Management should be delegated to an Executive Director, under the general policy supervision of a Board of Directors.

4. GENERAL OPERATIONAL OUTLINE. Careful consideration and planning must precede the setting up and operation of the UBIDC. Relationships, procedures and delegations of responsibility would greatly effect the successful operation of the corporation. These features are so broad in character that they apply in general to all government sponsored boards and corporations; they will be treated separately in Section XII of this report.

With particular respect to the operations of UBIDC, consideration of the following aspects should be entertained:

a. Responsibility for the extension of long term capital, the several operational corporations obtaining short term loans through normal channels.
b. Make available long term financing for expansion and modernization of existing industries.
c. Determine criteria which should govern decision as to assistance by loan or investment in consonance with development program.
d. Establish procedure to be pursued from the time a loan or investment application is made to evaluate the merit of the project properly and objectively.
e. To determine, in initiating new enterprises and in setting up new and separate operational corporations, should financial participation be open to the public.

These and similar functions require much consideration before firm recommendations can be made. It may be indicated, tentatively, that loans extended by the UBIDC should be primarily intermediate and long term in character, where fixed capital expenditures are required; that such loans should be extended only after it has been established that private capital is not available for the purpose; that for modernization and expansion of existing plants, loans are preferable to government participation in ownership; and that, prior to action on a loan or investment in an enterprise by an appropriately composed committee of the Banking and Investment Department, the recommendations of the Research and Technical Departments should be sought. With respect to the financing of new enterprises which are initiated, it is recommended that in general, financial participation be open to the public, unless circumstances in an individual case strongly favor State ownership exclusively.

H. SUMMARY OF RECOMMENDATIONS.

1. In order to activate the industrial expansion program, it is recommended that immediate action be taken toward the implementation of the following projects:

a. The establishment of a Union of Burma Development Corporation to foster and assist in the modernization and expansion of existing industry, and to sponsor, initiate or assist in new industrial development projects.

b. Construction of a new modern rice mill to serve as a model for modernizing existing and for the design of new ones. A training program in modern milling methods and procedures for technicians be instituted. Establishment of premium price scales as an incentive for reducing breakage in milling.

c. Establishment of a salt water fishing industry with an initial production goal of 20,000 tons of fish annually. Market survey to determine most acceptable form of preservation and processing.

d. Determination of salt well and spring reserves, exploration for new inland brine sources and procurement of preliminary designs of modern plants for both inland and sea water evaporation.

e. Procurement of preliminary designs for a bamboo pulp and paper mill in order that close estimates of capital and production costs may be made to permit a final judgment on the feasibility of the project.

f. Study of setting up a modern cigarette plant and the prospects for fully supplying domestically grown Virginia type tobacco to conserve foreign exchange and to provide increased Government revenue.

g. Market analysis of probable roof tile consumption be made and Government's plant proposal be reviewed in light of the findings.

h. Re-examine Government's proposal for the construction of three teak sawmills for the purpose of processing woods other than teak and integration of millwork production in them.

i. Make an engineering and economic study based on preliminary design for the production of rubber tires, tubes and industrial rubber goods.

j. A survey by a professional estimator be made of the steel scrap in order that a decision may be arrived at whether to erect suitable processing facilities or to sell or barter the scrap in the world market.

2. For further stimulation and expansion of the industrialization program, steps should be taken to implement the following:

a. Estimate of probable increased cement demand required by expansion program and to make engineering and economic study to determine whether expansion of existing or construction of new facilities is more feasible.

b. Study feasibility of increasing sugar cane acreage

and the introduction of a sale price scale for cultivators, obtain cost estimates of rehabilitation of existing raw and refined mills.

c. Study of production costs of soaps and consumer acceptance of better grades at a fair price. Also introduction of soap standards should be considered.

d. A market survey to be made to determine probable consumption of bottles, other shaped and flat glass with the object of establishing a modern glass plant if market development is promising.

e. Consider making available modernization capital and technical assistance to existing pottery plants.

f. Procure preliminary design of caustic soda and chlorine plant for integration with proposed salterns.

g. Provide for sulphuric acid manufacture in conjunction with future zinc ore reduction works.

h. Investigate possibility of growing jute on an industrial scale, and consider construction of jute processing plant to use imported jute until domestic crops are available.

i. Stimulate production of groundnuts to prewar level and explore possibility of increasing production to provide industrial vegetable oil supplies.

j. Preliminary investigation to determine type and annual requirements of fertilizer, availability and cost of raw materials, obtain preliminary plant design and estimate of capital cost and power requirement. Make tentative site selection based on power availability and cost and on transportation costs.

k. Market survey of soft drinks acceptance and consideration of incentives to private enterprise for establishment of a soft drink industry.

l. Analyze Government taxation, import, export, foreign exchange and related policies to ensure that they stimulate and facilitate industrial development and production to the maximum extent.

m. Make market and engineering studies for consumption and production of dairy products, processed grains and other industries consonant with the progress of the economic expansion program.

Section VIII

TRANSPORTATION

This section presents a discussion of certain general aspects of the transportation function within Burma. The following sections discuss Ports and Waterways, Railways, Highways, and Airways. Pipeline transportation, potentially significant, is not treated.

A. GENERAL CONSIDERATIONS.

1. The topography of Burma is such as to facilitate transportation in certain areas, impede it in others. The main land mass of Burma measures approximately 800 miles from north to south, with a longest east-west dimension of about 550 miles, and with the Tenasserim "peninsula" extending another 500 miles south from the southeast corner of the main land mass. The great central valley of the Irrawaddy River and its prime tributary, the Chindwin River, traverse Burma from north to south. The rivers are navigable through most of their length. They are paralleled by the Sittang and Salween Rivers, neither significantly navigable. The valleys of the Irrawaddy and Sittang Rivers are separated by the Pegu Yomas, and the combined central valley and delta is encircled on the east, north and west by the Shan Plateau and mountain ranges which insulate Burma quite effectively from its neighboring sovereign powers. There are literally no open routes by land or river carrying significant traffic to or from bordering countries; international traffic exists by sea and air. Accordingly, transportation is facilitated in central Burma, impeded in the "horse-shoe" of mountains around this area, and again facilitated by sea from the extensive coast line facing the Bay of Bengal and the Andaman Sea.

2. Naturally, the high density population areas of Burma are the valleys and deltas of the Irrawaddy and Sittang Rivers, and the delta of the Kaladan and Lemro Rivers in the Akyab area. Current population trends tend definitely toward a higher percentage increase in these areas than in the surrounding horseshoe of mountains, the Shan Plateau, or the Tenasserim Division.

3. Prior to World War II the transportation system of Burma was adequate to its then needs. Water, rail, motor, pipeline and bullock-cart provided for movement of traffic adequate to satisfy demands. Quality of service was excellent. World War II, and more particularly the insurrection, has altered this picture almost completely. Quality of service is low by any acceptable standard. No ground or water traffic moves without the danger of interference or interruption, apart from local traffic in major centers of population. Schedules are frequently, if not usually, irregular and uncertain. Movement is by day only, night movement being impracticable. Even the operation of aircraft by the Union of Burma Airways (UBA) is only by day, with the return of aircraft to Mingaladon for over-night storage being a specific operational requirement. Losses in floating plant, and in ways, structures, and rolling stock for land transport, are great, and constantly create artificially high operating costs and need for capital to replace fixed structures or plant. Armed guards on transport and at exceptionally important fixed installations reduce but do not prevent sabotage. This situation has given air transport a great stimulant and created for the UBA an artificial market. Clearly no adequate or efficient transport system for Burma as a whole can exist until law and order shall have been reestablished.

4. The need for an adequate and efficient transport system for Burma as a whole is obvious. The economic and commercial life of Burma are throttled by the lack of an effective transport system. The Government itself cannot govern areas made inaccessible by lack of communication or transport. The principle of restoration to pre-World War II standards and conditions is not enough; the problem is broader. The problem includes the opening up of vast under-developed and undeveloped territories rich in natural resources, bringing with it the

manifold advantages of commerce, industry, education, medicine and a higher plane of culture and social intercourse. Each mode of transport, as applicable, plays a vital role in such development. Without transport, such development is not possible. Burma definitely has a marked deficit in transportation means, which deficit should be made good in a logical and consistent pattern, based on a policy and plan which will avoid waste, uneconomical duplication and unreasonable competition.

5. The Government of the Union of Burma is in a most advantageous position with respect to its transportation system. It owns as a monopoly, and operates through autonomous Boards of its own creation, the Railroads, Airways and Inland Waterways. An exception of minor import and localized area exists with respect to waterways transited by the Arakan Flotilla Company, and in the privately owned craft which ply all waters. The Government of the Union of Burma (GUB) builds and regulates traffic upon the National and Main Roads; it can clearly exercise great, if not controlling influence, over the construction and use of District and Village roads. Hence, the means of transportation are substantially in its hands, and it can therefore establish sound policies for, and coordinate and regulate transportation in the best interests of Burma as an entity.

B. NEED FOR COORDINATION AND REGULATION OF TRANSPORTATION.

1. Each major agency of mass transportation,—the waterways, railways, highways and airways—nas its own natural sphere in which it is able to provide the most economic service. The existence of some overlapping areas does not vitiate this fundamental truth. Waterways afford the least costly means of transport, and have marked advantages in bulk and heavy commodities for long or short haul where time enroute is relatively unimportant. Railways have advantages in handling all types of commodities where the traffic is heavy and steady, especially for long-haul, and for regularity and certainty of schedule. Highways have high flexibility of routes and schedules, door-to-door service, little need for fixed facilities at origin or destination, and have distinct competitive advantages in short-haul traffic, even long-haul for certain commodities. The airways sell speed, and are competitive in any commodity which can afford the premium cost; it handles nearly all commodities in regions denied other modes of transport by too costly accessibility. It is obvious that the GUB should control transportation modes so as to permit, encourge and compel each to develop fully its own natural sphere, and regulate transportation so that competition in overlapping areas is fair and healthy.

2. The basic organizational concept and the general execution of that concept for each mode of transportation is sound. Minor adjustments are discussed in subsequent sections. The coordination of the four primary transportation modes is now the responsibility of the Ministry of Transportation and Communication. Without prejudice to the excellent work now being performed by that Ministry, it nevertheless appears that the scope of coordination and regulation of transportation modes is so broad a problem, its importance is so great, and the timeliness so urgent as to warrant the full study of a potentially more effective method of control. It is accordingly recommended that full investigation, analysis and evaluation be made of the optimum organizational pattern for, and that there then be established a Commission, composed of approximately three able men, knowledgeable in transportation, devoting their full time to this work, and supported by an adequate staff, having the following duties and responsibilities under the laws of Burma with respect to all modes of transportation, and reporting to the GUB through the Minister of Transportation and Communication:

a. Develop, propose and effect the establishment of a sound, comprehensive national transportation policy.
b. Regulate common and contract carriers.
c. Review and approve proposals for the extension or abandonment of transportation routes.
d. Establish and maintain just, reasonable and nondiscriminatory rates.
e. Establish through rates and joint rates.
f. Establish rules regarding the public posting of rates and regulations.
g. Compile and publish pertinent statistics, including traffic records.
h. Establish common type forms of accounts and records of common carriers.
i. Establish common type form for bills of lading.
j. Supervise the establishment of safety rules, appliances and equipment.
k. Supervise the investigation of serious accidents.

Such a Commission would be regulatory, not operational; it should have no operating function of any nature with respect to any mode of transportation. It would appear to be invaluable in its position above the operating companies and Boards, confining its work to purely regulatory functions to assure safe, reasonable and efficient transportation for Burma.

Section VIII-a

PORTS AND WATERWAYS

A. GENERAL CONSIDERATIONS

1. IMPORTANCE AND EXTENT. Burma's ports and waterways are of extreme importance to the national economy since these natural elements have been the principal avenue of commerce during the entire development of the country. The principal towns and cities are on the banks of the rivers and streams; the watercourses have served as a source of food, water, and social and commercial intercourse. Because waterways have for centuries carried the commerce to and from the heart of Burma the principal seaports are located near or at the mouths of the major rivers.

2. PORTS. The principal port of Burma is the Port of Rangoon. Other seaports include Akyab, Bassein, Moulmein, Tavoy and Mergui, and the lesser ports of Kyaukpyu, Sandoway and Victoria Point. The ports and the navigable inland waterways are shown on the attached map. The division of trade between the various Burma ports is shown by percentages in the following table.

TABLE I

DIVISION OF TRADE BETWEEN BURMA PORTS*
(1946-47)

	Total Foreign Trade In Per Cent	*Coasting*	*Total Foreign and Coasting*
Akyab	2.10	14.48	3.63
Moulmein	2.18	14.63	3.71
Bassein	6.95	0.91	6.21
Tavoy	1.25	4.67	1.67
Mergui	0.57	20.49	3.03
Kyaukpyu	—	0.02	—
Victoria Point	0.02	0.61	0.09
Sandoway	—	0.24	0.03
Total Subordinate Ports	13.07	56.05	18.37
Rangoon	86.93	43.95	81.63
Total	100	100	100

*From "Report on the Trade and Customs Administration of Burma for Official year 1946-47 (30 Sept. 47)".

3. INLAND WATERWAYS. Burma consists of a series of river-valleys, principally the Irrawaddy, the Sittang, and the Salween, running from north to south and divided from one another by mountain ranges and plateaux. These great rivers, their tributaries, and delta distributaries, offer over 5,000 miles of commercially navigable waterways and other thousands of miles used by country craft for the principal mode of travel and transport.

The Irrawaddy River, navigable for some 900 miles, traverses the most fertile lands and is Burma's main highway of commerce. Southward of Prome, the Irrawaddy, before entering the sea, branches into the many channels forming the Delta which is one of the rice granaries of the world, covering an area of over 10,000 square miles and having nearly 2,000 miles of navigable channels. The main tributary of the Irrawaddy is the Chindwin River which is navigable for some 400 miles above its mouth.

The Sittang River drains the Toungoo district and, after running for about 350 miles, opens out into a wide estuary noted for its tidal bores and empties her waters into the Gulf of Martaban about midway between Rangoon and Moulmein.

The third important river of Burma, the "wild" Salween, at present is navigable for only about 55 miles; however, two of its lower tributaries, the Gyaing and Attaran Rivers, are navigable for about 50 and 70 miles respectively.

Many of the smaller creeks and rivers are tidal and navigable for short distances and the other sections of the main rivers are navigable for local sampan, launch and barge traffic.

4. WAR DAMAGE. During the war nearly all ports in Burma, especially the Port of Rangoon, were subjected to repeated bombing from the air by the Japanese and the allies and to deliberate destruction of facilities and

floating equipment, first by the British and later by the Japanese, in order to prevent their use by the enemy. This resulted in the destruction of a large part of the fleet of river craft of the Irrawaddy Flotilla Company, serious destruction of port and docking facilities in Rangoon, and considerable destruction of port facilities in the minor ports.

5. MINE SWEEPING. During the war mines were laid by the Japanese, and by the British and the Americans in the approaches to several Burmese ports in order to deny the use of these ports to the enemy. The ports affected include Rangoon, Moulmein, Tavoy, Mergui and Victoria Point. The main channels approaching these ports have been swept, but the "unswept areas" are still considered dangerous.

The British Admiralty under date of 21 September, 1951, stated:

> "With reference to Admiralty letter dated 1st June, 1951, about mines in Burmese waters, I am to inform you that all the dangerous areas resulting from mines laid in Burmese waters during the second World War will be considered no longer dangerous after the 1st November 1951. These areas are described in Admiralty Notice to Mariners No. 2320 (T) of 1950.
>
> "The last unsterilized mines were laid in January 1945, and it is considered that any mines which were not accounted for during the mine clearance operations after the war ended must now be dead after having laid in the mud and water for approximately seven years, but it must be appreciated, however, that a very remote risk will remain for some time to come."

And under date of 26 October, 1951, the Admiralty stated:

> "The remote risks clause is applied to all areas in all parts of the world in which ground mines have been laid whether the area has been swept or not.
>
> "So long as there are mines containing explosives laying on the bottom there must be an element of risk that something may cause them to detonate.
>
> "As such instances are very rare the risk is regarded as remote."

By letter dated December 29, 1950, from ECA in Washington, it is stated:

> "It is the opinion of the Bureau of Ordnance, U. S. Navy, that the U. S. and British mines laid between 1943 and 1945 in the approaches to Rangoon harbor are still dangerous and will continue to be dangerous for two to five years."

This means till the end of 1955.

This letter further states:

> "The main danger from these mines is that they might be disturbed by dredging or by being dislodged by an anchor."

Before any dredging operations are commenced in any areas known to have been mined, steps should be taken to remove or detonate all mines remaining therein. The responsibility for requesting such removal should rest with the agency authorizing or directing the dredging. It is understood that plans call for mine sweeping operations by the Burma Navy to commence with two reconditioned mine sweepers about April 1, 1952, first in clearing the unswept areas in the approaches to Rangoon, and then to proceed to Moulmein.

6. SECURITY. The insurrection since 1948 has had a marked effect on the restoration of the internal transportation of Burma and consequently on the export and import traffic of the various Burmese ports. Its effect on the revival of traffic on the inland waterways is shown clearly in Chart No. I. This chart shows that the ton-miles of freight carried by the Inland Water Transport Board reached a peak after the war of about 7,500,000 ton-miles in March and April, 1948, and dropped to about 600,000 in February, 1949, apparently due to the lack of security for their vessels in traversing the inland waterways. It started to rise again slowly in November, 1949, and then more rapidly in July, 1950, reaching a peak of about 12,000,000 ton-miles in September, 1950, which figure has been generally maintained up to June, 1951, the date of the last record.

The effect of the insurrection on the traffic in the Port of Rangoon is shown by the following, which gives the total traffic in and out of the port:

Prewar.	1936, 1937, 1938, 1939; each year in excess of	5,000,000 tons
Postwar.	1947-48	2,037,657 tons
	1948-49	1,483,244 "
	1949-50	1,390,120 "
	1950-51	1,911,631 "

This shows that the revival of traffic after the war in the Port of Rangoon promptly brought the tonnage in 1947-48 up to 40 per cent of prewar tonnage; however, the insurrection apparently not only stopped its normal increase but reduced it to about 28 per cent of prewar, in 1949-50.

7. ORGANIZATION.

a. The Port of Rangoon is maintained and operated under the provisions of the Rangoon Port Act, 1905, by the "Commissioners for the Port of Rangoon". The Commission, consisting of seventeen Commissioners, is responsible for maintaining, marking and lighting the entrance channel and the harbor. It provides pilotage for ships entering or leaving and within the harbor, and provides and maintains moorings, anchorages and public wharves and jetties and all facilities pertaining thereto. It controls the movement of shipping and the unloading and storing of cargoes on public wharves. Lighterage within the Port is handled by the Inland Water Transport Board.

b. All other Deep Sea Ports, referred to as "Outports," are under the general supervision of the Nautical Adviser and Principal Officer, Mercantile Marine Department under the Ministry of Transport and Communication. The Port Officers of the three major outports of Akyab, Bassein and Moulmein are officers of the Mercantile Marine Department, who act under the Commissioner of the Division, and are to a certain extent guided by a local Port Advisory Board. The ports of Tavoy and Mergui have no Port Officer of the Marine Department, but are operated by a Deputy Commissioner. It is understood that a proposed Ports Act is now before the Parliament, which, if approved, would set up a new organization giving the office of the Nautical Adviser definite authority and responsibility for operating and maintaining all outports.

c. The Inland Water Transport Board which consists of fourteen members, under the Ministry of Transport and Communication, is responsible for operating, regulating and controlling inland water transport in Burma. The responsibility for maintaining and marking channels in those waterways, however, rests with the Nautical Adviser and Principal Officer of the Mercantile Marine Department. The operation of river transport in Arakan is presently handled by the Arakan Flotilla Company based at the Port of Akyab. This company is a privately owned subsidiary of the British India Steam Navigation Company.

B. DEEP WATER PORTS

1. THE PORT OF RANGOON.

a. Entrance Channel.

(1) Depths and Widths. The City and Port of Rangoon is situated on the Rangoon River about 21 nautical miles from the Andaman Sea. The width of the river at its mouth, from Elephant Point on the west to Grove Point on the east, is about three and a half nautical miles. The bar extends about 10 nautical miles outside of the entrance in all directions with the best depths across the bar closs to the western shore. Depths in the channel over the bar are approximately as follows:

About 18′ at M.L.W. Springs
About 23½′ at M.L.W. Neaps
About 32′ at M.H.W. Neaps
About 37′ at M.H.W. Springs

Vessels with a maximum draft of 30 feet can cross the bar on any ordinary high water provided there is no excessive swell or wave action. Five of the vessels entering Rangoon in 1940-41 were of 32-foot draft.

Proceeding upstream, the channel passes between Elephant Point and a middle ground of shoal water. Here the channel buoys have to be shifted occasionally—about once a year—to mark the changes in the channel due to the gradual advance eastward of the sandspit southeast of Elephant Point. Above Elephant Point, the channel follows the west bank of the river for about 8 miles, where it crosses and follows the east bank to the confluence of the Rangoon and Pegu Rivers. The depths in the channel are ample in all of this stretch, with widths varying from 1,500 to 3,000 feet.

(2) Mines. Mine planting during the war was all done in the lower reaches of the river and its sea approaches. The channel in this area follows the west bank of the river to Elephant Point and over the bar outside near the western shore. The searched channel has a length about 22 nautical miles and a maximum width of about 3,000 feet. Outside of the searched channel there are considerable areas which have not been swept and which should be swept as soon as possible. The Port Commissioners of Rangoon, in 1947 and 1948, lost their two seagoing survey vessels which were blown up and sunk by mines in these unswept areas.

(3) Navigational Difficulties. There are no serious navigational difficulties as the channel is well-marked and lighted. The only place where there is any trouble is at the turn around Elephant Point where the entrance channel swings to the left, or west, almost 90 degrees. At this point it appears that the sand spit southeast of Elephant Point has been gradually building to the eastward forcing the channel to move east causing more frequent changes in the buoys than elsewhere along the channel. A ship went aground at this point on 19 October 1951, but was freed without serious damage within a few days.

b. Rangoon Harbor.

(1) Depths and Widths. Rangoon Harbor extends from a point in the Rangoon River opposite the mouth of Shwe Byauk Creek (seven miles below Rangoon), upstream to the junction of the Rangoon River with the Pegu River and Pazundaung Creek near Monkey Point thence up the Rangoon River in front of the city for about eight nautical miles to the junction of the Panhlaing and Hlaing Rivers. It also extends up the Pazundaung Creek for about four nautical miles to the City Limits; and a mile and a half up the Pegu River.

From the western end of the harbor, the Rangoon River flows south for about three nautical miles, then turns east where the outflowing current is directed along the front of the City wharves on the left (north) bank by the Soikgyi Wall constructed on the right (south) bank on the arc of a circle terminating at the western side of the entrance to the Twante Canal. The width of the channel in this reach varies from 1,500 to 2,000 feet with ample depths for any draft, except along the

Seikgyi Wall where the deep water narrows to a width of about 600 feet at one point.

The Twante Canal, providing a navigable connection for river craft with the Irrawaddy River and its delta, enters the Rangoon River from the southwest. From this point the river flows wide and deep for about two miles providing ample room for mooring at least fifteen large ships. The width in this reach is from 2,000 to 3,000 feet, with depth along the right bank of 25 to 30 feet, at low tide, and along the City wharves on the left bank with depths of 35 to 50 feet.

As the river widens to its junction with the Pegu River and Pazundaung Creek it gets progressively shallower forming a bar south of Monkey Point. On the right (south) bank a training wall known as Kings Bank Wall was constructed about 1928 for the purpose of confining the ebb tide over the bar south of Monkey Point in order to increase its scouring effect in the channel on the left (north) side of the bar. This wall narrows the width of flow over the bar from about 9,000 to 6,000 feet.

Dredging is required in the Monkey Point Channel every day during the dry season to maintain a channel about 700 feet wide with depths of from 14 to 16 feet below M.L.W. in order to permit access to Rangoon Harbor. During the rainy season the ebb tide maintains this channel by scouring action. The Port Commission operates the suction dredge "Cormorant" mainly for dredging at Monkey Point or in the approaches thereto. The depths elsewhere in the harbor are generally ample for the movement or mooring at all stages of the tide, of ships of any draft which can pass Monkey Point. The annual dredging in Monkey Point Channel and approaches during the period from 1922 to 1940 varied between 607,000 tons and 1,285,000 tons.

The tidal range in Rangoon Harbor for greatest ordinary spring tides is about 16½ feet, and about 9 feet for mean neap tides. The tidal current attains speeds up to 6 knots. During the rainy season—May to October—the ebb tide is so strong that frequently vessels in Rangoon Harbor will not turn to meet the flood tide.

Pazundaung Creek provides an extension of the harbor about 4 miles long with private and Government establishments on each bank. The bar at the entrance has about seven feet of water at low tide, but inside the bar the channel has depths of 18 to 30 feet and widths of 200′ to 500′.

(2) Obstructions. There are many wrecks in and around Rangoon Harbor, but they do not interfere materially with the commerce of the port today. Some have already been removed by the Port Commissioners.

At least nine are on the Ahlone Shoal or "Fants Dump" on the left (north) bank opposite Seikgyi Wall, above the mouth of the Twante Canal; nine more are near the shore along the right (south) bank in front, or east of the Dalla Dockyards of the Inland Water Transport Board; a sunken dredge is in the Twante Canal which should be removed; and two wrecks in the mooring areas for big ships should be removed: one opposite William St. Jetty with 24 ft. over it at low water; and one opposite Judah Ezekiel St. with 23 ft. over it at low water.

(3) Mooring Buoys. There are 15 first-class mooring buoys in Rangoon Harbor, one of which is specially designed to take the largest vessel capable of entering the harbor. In addition there are 3 first-class mooring buoys east of Monkey Point bar near Syriam for vessels carrying petroleum, one of which is reserved for the Burmah Oil Company.

The Port Commissioners have estimated that 16 sets of additional moorings (8 double sets) will be needed to accommodate shipping of prewar volume.

(4) Wharves and Jetties. All public wharves and jetties* are on the left (north) bank of the Rangoon River and extend for about seven miles westward from Monkey Point. Private or Government establishments extend along the south bank of the Rangoon River and on both sides of Pazundaung Creek.

The principal public wharves where ships can be unloaded are:

The Ahlone Wharf (1 berth 450′ long)
The Sule Pagoda Wharves (7 berths, 3 about 450′ long now operating, and 4 about 500′ long only one now operating).
The Brooking Street Wharves (2 berths, each 450′ long).

In addition to the above-mentioned public wharves there are many public jetties along the City water front for the use of the river craft of the Inland Water Transport Board (I.W.T.B.); for ferries to and from the Delta or river port; for the use of privately-owned local cargo craft; as well as the jetties of private corporations.

The Burma Railroad runs in the rear of all these wharves and jetties on the city (north) side of the harbor with sidings conveniently placed to handle cargo. Strand Road, which parallels the water front, provides similar access for truck traffic to all points in the city.

(5) Warehouses & Mechanical Facilities.

(a) Ahlone Wharf. Three steel warehouses with a floor area of 90,000 sq. ft. are now under construction with funds furnished by E. C. A.

(b) Sule Pagoda Wharves. Berths 1, 2 and 3. Each now has a one-story brick warehouse with a floor area

*A "jetty" is a term used in Burma for a floating pontoon connected to a pier on shore by a truss bridge hinged at both ends.

of about 55,000 sq. ft. New steel frame open sheds will be constructed at each berth with funds furnished by E.C.A. One 3-ton travelling crane which served berth No. 2 will require complete overhaul and reconditioning. Four new 2-ton cranes are now in storage awaiting erection here, and two 1½-ton cranes now at Brooking Street will be transferred to Sule Pagoda Wharves after reconditioning.

Berth No. 4 now has wartime Nissen huts for storage purposes to be replaced by a one-story steel warehouse with a floor capacity of 63,000 sq. ft. to be constructed with funds furnished by E.C.A.

Berths 5, 6 and 7 are not in use as war damage completely destroyed a large part of berths 5 and 6; nearly all of berth 7 settled about 1½ feet and moved several inches riverward due to overloading and poor foundation conditions. There are some small warehouses on the remainder of berth 5, and larger warehouses on berth 6 and 7.

(c) Brooking Street Wharves. Berth No. 1 has a one-story brick warehouse with a floor area of 36,000 sq. ft. A 40-ton crane mounted on rails at right angles to the face of the wharf is about 125 ft. from the west end of the wharf. It is in operating condition.

Berth No. 2 has temporary warehouses which are to be replaced by a one-story steel warehouse with a floor area of 51,000 sq. ft. to be constructed with funds furnished by E.C.A.

(d) Cargo Handling Equipment. There are eight 1½-ton cranes which were recovered from the river after the war and are standing on the Brooking Street Wharves. These are to be disposed of as follows (letter of 6 December 1950 from Port Commissioner to Mr. Branning): Two will be reconditioned and moved to Sule Pagoda Wharves as noted above; four will be reconditioned and put into service at Brooking Street; and two will be dismantled and scrapped.

18 one-ton electric motor driven tractors with pneumatic tires, and 72 one-ton low-loading 5′ x 3′ platform trailers on heavy pneumatic or solid tires are being procured for the Port of Rangoon with funds furnished by E.C.A.

(6) Boat Yards and Docking Facilities. The principal boat yards in the Port of Rangoon are as follows:

(a) The Dalla Dockyard of the Inland Water Transport Board is located across the river from the City of Rangoon on the south bank. It is well equipped with shops and thirteen slipways capable of handling vessels up to 500 tons on a single slipway or 1200 tons on six adjacent slipways, each with a capacity of 200 tons, designed for hauling out ships sideways up to about 250 feet in length.

(b) The Government Dockyard on the east side of Pazundaung Creek operated under the direction of the Nautical Adviser and Principal Officer, Mercantile Marine Department of the Ministry of Transport and Communications, has shops and facilities for repairing government craft including small naval vessels. Its capacity is not sufficient to handle expeditiously the many craft awaiting repairs.

(c) The Port Commissioners Yard and Work Shops, located on the north bank of the river just east of Brooking Street Wharves, includes shops and slipways capable of handling vessels up to 100 ft. in length.

(d) Kahn's Graving Dock, the only dry dock in Rangoon, is located on the west bank of Pazundaung Creek about 2 miles from its mouth. It is privately owned and will take vessels up to 1,000 tons and 200′ x 40′ x 13′ draft. This is too small to take some of the larger craft pertaining to Port or Government operations. It would appear advisable that the size and capacity of graving dock to serve all Government agencies in Rangoon should be determined; preliminary site investigations should be carried out to arrive at an approximate estimate of cost and economic justification.

(7) War Damage. The Port and City of Rangoon suffered greatly during the war, first from bombing by the Japanese, then from demolition and destruction of port facilities to deny their use to the Japanese when Rangoon was evacuated in March, 1942; and finally from allied bombing during the three years 1942 to 1945 when the City was occupied by the Japanese. The entire dock area was badly damaged, cranes, pontoons and bridges were dumped into the river, and sunken steamers and other wreckage prevented access to what remained of the wharves and jetties. Important dock yards, shops, and other facilities were also destroyed.

(8) Rehabilitation.

(a) Upon the return of the British in May, 1945, immediate steps were taken to clear up the water front, raise or remove sunken pontoons, cranes and other wreckage, and replace warehouses, pontoon jetties, and other facilities with materials available such as—Army Nissen huts, Bailey bridges, Navy-assembled pontoons, etc. The Port was put in operating condition in a remarkably short time and in 1947-48 handled more than 40 per cent of prewar tonnage.

(b) A Five-Year Program was prepared in 1949 and 1950 by the Commissioners for the Port of Rangoon for complete rehabilitation of the Port to bring it back to prewar status. In addition the completion of the warehouses and facilities at Ahlone Wharf started before the war for handling rice export directly from rail or highway to the ship were included in the program, as well as

certain other new structures or facilities which were deemed necessary by the Port Commission. A summary of this program is given in Table II which follows.

TABLE II
FIVE-YEAR PROGRAM FOR THE PORT OF RANGOON SUMMARY OF ESTIMATED CAPITAL EXPENDITURE

		Breakdown of total Expenditure to show		
	Total	*Material & Plant to be Purchased Outside Burma*	*Local Materials*	*Local Labor*
	Rs.	*Rs.*	*Rs.*	*Rs.*
I. Wharves & Equipment	92,85,000	56,78,500	9,35,000	26,71,000
II. Godowns & Other Buildings	44,90,000	18,72,000	10,51,000	15,67,000
III. Pontoons, Bridges, Jetties & Pontoon Moorings	59,54,000	41,35,100	4,61,100	13,57,800
IV. Flotilla	1,27,70,000	1,24,56,000	—	3,14,000
V. Steamer Moorings	80,00,000	80,00,000	—	—
VI. Miscellaneous	34,50,000	20,00,000	7,25,000	7,25,000
TOTALS	4,39,49,000	3,41,41,600	31,72,600	66,34,800
Equivalent dollar cost	$ 9,229,290	$ 7,169,736	$ 666,246	$ 1,393,308

This program estimates the total cost of materials and plant to be purchased *outside of Burma* at Rs. 3,41,41,-600 equivalent at the present rate of exchange to about $7,169,736.00. The local material and local labor to be procured in Burma totals about Rs. 98 lakhs which is equivalent to $2,059,554 or the total Five-Year Program prepared by the Port Commission was estimated at over $9,000,000.

E.C.A. has already set up funds amounting to $2,449,-000 to provide the dollar requirements for the items in the Five-Year Program listed in the following Table. The funds set up by E.C.A. for these items average about 40 per cent higher than the amounts estimated by the Port Commissioners for the same items.

(c) Seven Year Program. On 24 December 1951 the Commissioners for the Port of Rangoon completed a revised program of "Estimated Capital Works and Expenditures—1952 - 1958 (7 years)" which, together with its explanatory note, is attached as Appendix A.

A comparison of this program with the 1950 "Five Year Program" indicates that it contains essentially the same items as the Five Year Program, less those already provided for by E.C.A., and with the addition of a bucket dredger estimated at Rs. 20 lakhs and a graving dock estimated at Rs. 54 lakhs. The total estimated cost is Rs. 509.5 lakhs as against 439.5 for the Five Year Program. Subtracting Rs. 74 lakhs from the cost of the Seven Year Program for the bucket dredger and graving dock, and 116.5 lakhs from the cost of the Five Year Program for the cost of the equipment already provided for from E.C.A. funds—there remains Rs. 435.5 lakhs as the new estimate for essentially the same items. 35 per-cent higher than the Five Year Program estimate. The estimated cost in the Seven Year Program of the "Flotilla" of 29 vessels (omitting the bucket dredger) is 67 per cent greater than the estimate for the same vessels in the Five Year Program. The general increase in the estimates of about 35 per cent checks closely with the cost of the equipment provided for from E.C.A. funds. With reference to the increase of 67 per cent in the estimate for

TABLE III
FUNDS COMMITTED BY ECA FOR THE RANGOON PORT REHABILITATION PROJECT PROPOSAL NO. 4

ECA Doc.	*No.*	*Description of ITEM*		*Est. Cost U.S. Dollars*	*STATUS Jan. 8, 1952 Procurement authorities & Purchase Requisitions rec'd from Washington*
PP-4	10	Pontoon 120′ x 20′		212,000	
CPR-1					
CPR-1	1	Tank Pontoon 500′ x 40′		208,000	
CPR-1	5	Transit Sheds		530,000	
CPR-1	16 items	Machinery & equipment workshop		50,000	
		Transportation on above,	20%	200,000	
		Total		$1,200,000	$1,227,000
CPR-2	5	3-ton diesel caterpillar cranes		90,000	
		Transportation	20%	18,000	
		Total		108,000	135,000
CPR-3	6	150 KV Circuit breakers & Transformers		22,500 15,000	
		Transportation	20%	7,500	
		Total		45,000	50,000
CPR-4	18	1-ton electric tractors			
CPR-4	72	1-ton platform trailers			
CPR-4	36	Batteries for tractors			
CPR-4	12	Battery chargers, Spare parts for above		150,000	
		Transportation	20%	30,000	
		Total		180,000	180,000
CPR-5	26 items	Civil Engr'g Plant & tool equipment		57,806	84,000
CPR-6	3	Material for 3 steel open sheds		90,000	95,000
CPR-7	2	80′ steel bridges		8,000	
	1	140′ steel bridges		5,000	
		Plus 25% increase		3,250	
		Plus 20% transportation		3,250	
		Total		19,500	20,000
CPR-8	2 sets	Fixed Moorings (double sets)		84,000	84,000
CPR-9	3	Tank 200′ x 40′ Pontoons		330,000	330,000
CPR-10	2	Tank 200′ x 40′ Pontoons		220,000	250,000
TAR-1	1	Trainee in Hydrography		10,600	13,000
		Total P. P. — 4		$2,344,906	$2,449,000

vessels, it is understood that the latest estimates in the Seven Year Program are based in many cases on tenders received by the Port Commissioners in the interim between the preparation of the two programs.

(d) The reconstruction of berths 5, 6 & 7, Sule Pagoda Wharves has not been provided for in the Commissioners' Seven Year Program except for an item of 2 lakhs in the 3rd and 4th year for "Site investigation". In our opinion this investigation is important and should be started at an early date to determine definitely whether this site can be utilized economically for restoring the port to its pre-war capacity.

c. Commerce.

(1) The Port of Rangoon is the only port capable of receiving and distributing goods effectively to the larger part of Burma by rail, water, highway or air. It serves Rangoon, the principal industrial center and capital of the Union, handling more than 85 per cent of the foreign trade of the country. The freight handled at the Port of Rangoon before the war is as follows:

TABLE IV

PREWAR TONNAGE AT PORT OF RANGOON

(Thousands of Long Tons)

	1936	1937	1938	1939
Imports	1,325.5	1,318.9	1,430.2	1,400.3
Exports	3,891.1	3,940.1	3,959.8	3,579.2
Transhipments	23.9	29.1	28.6	26.6
Total	5,240.5	5,288.1	5,418.6	5,006.1

(2) The following table shows the principal commodities handled in the Port of Rangoon with the tonnages exported and imported prewar and postwar.

TABLE V

PRINCIPAL COMMODITIES
PORT OF RANGOON

Export and Import Tonnages (in thousands of long tons)

	Prewar				
Exports	1940-41	1947-48	1948-49	1949-50	1950-51
P.O.L.	774.1	16.4	17.4	15.8	18.6
Rice and Rice Products	2,192.0	903.0	777.4	730.7	1,018.1
Timber	192.9	96.0	54.1	8.8	56.2
Minerals	72.2	7.0	9.7	.8	17.4
Others	317.1	191.7	111.3	101.2	150.5
Sub-Total	3,552.9	1,214.1	969.9	857.3	1,260.8
Imports					
Coal	326.7	173.7	84.9	102.1	124.6
P.O.L.	86.0	185.0	137.2	123.6	113.2
Salt	23.1	24.0	40.0	18.5	20.9
General Merchandise	958.3	440.9	251.2	288.6	392.1
Sub-Total	1,394.1	823.6	513.3	532.8	650.8
Total Volume of Traffic	4,947.0	2,037.7	1,483.2	1,390.1	1,911.6

(3) After the present civil disorders have been terminated and the natural resources of Burma are developed as envisioned in this report, it is estimated that the Port of Rangoon should be prepared to handle approximately 3,500,000 tons of exports, 2,000,000 tons of imports, or a total of 5,500,000 tons as shown on Chart No. II herewith. For the purpose of this report it is assumed that this goal will be reached by 1959.

(4) In general, all exports are handled in lighters to ships in midstream, and imports are unloaded directly onto the wharves. However, Ahlone Wharf is prepared to receive rice for export by rail or highway directly into warehouses at the wharf for loading on ships without lighterage.

(5) The facilities for handling the present commerce appear to be adequate, but certain replacements of vessels, moorings, buildings and cargo handling equipment as listed by the Port Commissioners, including the rehabilitation of Sule Pagoda Wharves numbers 5, 6 and 7 and the need for a graving block should be given careful consideration.

d. Recommendations—Port of Rangoon.

(1) The program submitted on December 24, 1951, by the Commissioners of the Port of Rangoon (Appendix A) amounts to Rs. 509.5 lakhs or $10,699,500. A large part of this program might be self-liquidating if the port charges are increased a reasonable amount as permitted in existing law. A study of the complete port program is therefore recommended to consider carefully the need for, the priority, and the estimated cost of all items, as well as the question of possibly financing part of the program by some adjustment of port charges. However, the procurement of one buoy vessel to replace the one now on loan from the British Admiralty appears to be urgent, and is recommended for immediate approval. Certain other items connected directly with the efficient handling of cargo in the port as listed below are also recommended at this time.

(2) Items recommended for immediate development selected from the Port Commissioner's Program (Appendix A) are as follows:

I. Flotilla
  (a) 1 Buoy Vessel
II. Wharves & Equipment
  (a) Roads & Rail Tracks
  (b) Ancillary Buildings
  (c) Mechanical Handling Equipment
III. Godowns and other Buildings
  (a) Stores and Workshops Buildings
IV. Miscellaneous
  (a) Engineering and Work Shops Plant

(3) Projects recommended for comprehensive study and investigation are as follows:

(a) Study of the foundation conditions at berths 5, 6 and 7, Sule Pagoda Wharves, to determine whether it is economically feasible to reconstruct these wharves for full commercial use, and if not what plans for their use are most practical.

(b) Study the improvement of foreshore at Lanmadaw

to relieve congestion of inland traffic in that part of the Port of Rangoon.

(c) Study the need for, the estimated cost of, and the port revenues for all items on the Program submitted by the Port Commissioners of the Port of Rangoon which are not included in the "recommendation for immediate development" in par. (2) preceding.

(d) Prepare a general plan for the expansion of the Port of Rangoon to accommodate the estimated increase in commerce which should develop in 1959 after the present internal disturbances are terminated and the resources of Burma have been developed as envisioned in this report.

(e) Study the need for a graving dock in the Port of Rangoon; its size; location; estimated cost and time to build; and economic justification.

2. AKYAB.

a. Entrance Channel.

(1) The City of Akyab is situated on the southernmost part of Paton Peninsula. The main harbor for seaborne commerce is on the eastern side of the city and in the estuary or mouth of the Kaladan River. From the sea-buoy off Fakir Point and Fakir Reef, marking the entrance to the waterway, it is only 2.3 sea miles to the Main Wharf at Akyab. The sea harbor is exposed to considerable wave action, having a fetch of 6 nautical miles to the northeast and about 5 miles to the southeast. The principal harbor for small craft is in Satyogya Chaung (Cherogeah Creek), the entrance of which is 1.3 sea miles above the Main Wharf.

(2) Depths and Widths. Approaching from the sea, and about 3 nautical miles out from the Fakir Reef light, there is a shoal area with depths as shallow as 15 feet over which the seas break heavily during southwest monsoon weather. These shoals are often called the Outer Bar. On either side of the shoals there is a wide channel with depths in excess of 26 feet. Between the Outer Bar and Fakir Reef light depths vary from 26 to over 150 feet and width clearances are unlimited. From the buoy the depth shoals fast so that in one nautical mile they have decreased to about 20.5 feet M.L.W.S. and just below the entrance to the Akyab harbor to about 19.5 feet in a section called the Inner Bar. The Inner Bar crossing appears to be the critical depth area of the entrance channel and in terms of tidal stages would be:

M.L.W.S.	*M.L.W.N.*	*M.H.W.S.*	*M.H.W.N.*
19.5 feet	21.7 feet	26.8 feet	24.7 feet

Considering the 3-fathom contour (M.L.W.S. datum) as indicating the limits of the channel required for sea-going vessels, the widths can be considered as unlimited up to the Inner Bar area which is about 1.3 nautical miles above the Fakir Reef buoy. Here the channel begins narrowing down until a minimum width of about 700 feet appears about 0.3 miles upstream. The average width of the channel near the harbor entrance appears to be about 1,300 feet.

(3) Mines. No mines were placed either in the Akyab channel or harbor by the Allied Forces. No sweeping is required.

(4) Wrecks and Other Obstructions. There is one wreck located about 1.7 nautical miles above the Fakir Reef light or opposite the Inner Bar; however, it does not interfere with navigation. There are no other wrecks or obstructions hazardous to navigation in the Akyab channel.

(5) Navigational Difficulties. The principal difficulties to navigation are the Outer and Inner Bars; therefore, pilot service is used. There are no sharp curves and the courses are relatively straight, but the bar conditions are variable, shifting continuously in the alluvial deposits, and channel movement and current knowledge of these conditions are required for safe and dependable transit.

(6) Channel Rehabilitation Activities. Since there were no mine-laying activities on this channel or wreckage impeding sea-going commerce, there have been no rehabilitation measures needed to open the channel to post-war commerce.

b. Port, Harbor and Anchorages.

(1) Depths and Widths. The main harbor for sea-going commerce at Akyab is in the Kaladan River estuary fronted by the city. The central section of the channel, as defined by the 18-foot contour averages about 2,200 feet in width and has depths varying from about 19 to 27 feet M.L.W.S. This condition, extending for over two miles upriver, offers a good anchorage for vessels and for the lightering of cargo. Opposite the section between the Stone Pier and the Main Wharf the width of the channel has the tendency to narrow down and here widths as little as 1,000 feet can be expected; however, depths from 19 to 21 feet M.L.W.S. appear consistent. Along the Akyab foreshore, and especially in front of the section from the Stone Pier to the Main Wharf, there is a tendency for silt deposition and maintenance dredging usually is required in this section.

The inner harbor at Akyab, formed by the Satyogya Chaung (Cherogeah Creek) is the principal harbor for small craft and it is along this channel where the private industries are located. Depths and widths are adequate in the inner harbor for the type of craft operating and berthing there.

(2) Obstructions. Foreshore shoaling presents the principal obstruction to port operation at Akyab. There are no wrecks or other obstructions which interfere with commerce in the harbor area.

(3) Mooring Buoys and Docks. In the Kaladan River harbor area there are no mooring buoys provided for large vessels; however, through E.C.A. assistance two buoys now are being installed there. The principal wharf is the Main Wharf, a T-shaped structure extending into the river at which it was possible for vessels to berth and transfer cargo. The other principal structure was the Stone Pier which extends out from the shore a distance sufficient for berthing smaller vessels.

Along the banks of Satyogya Chaung (Cherogeah Creek) there are a great number of small private docks for the barge, sampan, and small-craft trade. These structures are privately owned and are not available for general cargo handling. This inner harbor is well protected and offers an excellent sheltered harbor for small-craft commerce.

(4) Warehouses. Until recently there were no public warehousing facilities offered at this port. The following, all located at the Main Wharf, is the present status of warehousing:

Cargo Godown	100′ x 90′	Completed
Cargo Godown	112′ x 75′	Under construction
Oil Godown	70′ x 30′	Completed
Gunny Godown	82′ x35′ (Nissen)	Being used as workshop
Customs Examination	80′ x 60′	Completed
Cargo Sheds (2)	63′ x 17′	Early construction scheduled

(5) Mechanical Facilities. The cargo-handling facilities include one steam crane (7 tons), two hand cranes (2 tons), one tractor crane (2 tons), and one roustabout (1 ton). This equipment is in only fair condition and it is considered that two additional cranes (7 and 3 ton) should be installed on the T-head wharf.

(6) War Damage. Both the Main Wharf and Stone Pier were heavily bombed during the past war and were badly damaged. All port facilities, godowns, and customs were wiped out. The majority of the mills and other industries were destroyed and a great number of small craft were sunk in Cherogeah Creek practically destroying its usefulness as a harbor.

(7) Rehabilitation Activities at Port. The principal rehabilitation activity carried out since the war has been the removal of the wreckage in Cherogeah Creek. This program, carried out through the assistance of the Ministry of National Planning, is essentially completed and the inner harbor prewar navigation clearances restored. Major rehabilitation measures are being accomplished on the Main Wharf and Stone Pier and the restoration of these facilities should be completed at an early date.

c. Commerce. Akyab's only commerce of any importance is rice and rice products, and it is the oldest rice exporting port in Burma. It is the only port other than Rangoon where large vessels may anchor alongside its docks. Prior to World War II, the port consistently maintained an important part in rice export and from 1924 through 1941 it averaged about 239,000 long tons of commerce annually, varying from a low of about 198,000 tons in 1925-1926 to a high of about 279,500 tons in 1933-1934. Practically all ot its commerce is in paddy, rice, bran, and other rice products and minor tonnages of civil and military supplies and general merchandise are imported.

Akyab serves as the major port for the Kaladan-Lemro Rivers, a combined section of productive paddy land of about 1,000 square miles. There are at present in operation in Akyab 26 mills for processing rice, averaging about 60 tons per day per mill. Most of the paddy is brought into the port by country boat. After processing, the rice is placed in lighters for loading to vessels in coast-wise and seagoing trade, because of the shoaled-in area in front of the Main Wharf.

Subsequent to the past war, Akyab still has been serving as the principal port for the Arakan area; however, because of the extreme damage to the port, city, and milling area, it has had a very slow recovery in commerce. During the past 2 fiscal years, the waterborne commerce, in long tons, has been as follows:

	Import Misc. Cargo	*Export Misc. Cargo*	*Export Rice & Rice Products*	*Total*
1949-50	10,747	739	78,098	89,584
1950-51	15,462	1,284	80,480	97,226

In comparison of commerce it appears that the present commerce is slightly less than 41 per cent of the prewar average. Since the same agricultural area is served by the port and since waterways will continue to be the principal avenues of commerce it can be assumed that commerce will soon return to the pre-war norm. With further developments in rice culture and land use a somewhat larger commerce can be expected at Akyab, an increase probably as high as 25 per cent over the prewar level.

d. Recommendations. To again serve the needs of commerce the Port of Akyab and the inner harbor on Satyogya Chaung (Sherogeah Creek) must be rehabilitated to the degree whereby it can adequately fulfill the requirements of navigation. The removal of wrecks and other obstructions in Cherogeah Creek is virtually complete. The reconstruction of the Stone Pier and Main Wharf is progressing, and the reconstruction of warehousing facilities scheduled for early completion. Cargo handling facilities should be augmented by the addition of two cranes (7-ton and 3-ton capacity, respectively) on the Main Wharf. Further structure rehabilitation probably will not be required until considerably more commerce is handled. To permit full use of cargo-handling facilities at this port, dredging in

the berthing area should be accomplished at as early a date as practicable. In addition, study should be continued at this port to permit full comprehensive analysis of the port, waterways, and potential trade in Akyab and Arakan area.

3. BASSEIN.

a. Entrance Channel.

(1) The City and Port of Bassein are located on the Bassein River about 72 nautical miles upstream of the Diamond Island light, the beacon indicating the entrance to the waterway, and about 65 miles upstream of the mouth of the river proper. The Bassein River is in an alluvial basin and forms a part of the Irrawaddy River delta system. Navigation by local barges and sampans is carried out on the river to the Irrawaddy by a number of interconnecting channels; however, the principal route of inter-traffic is on the connecting Panmawadi River, which is traversed by the Inland Water Transport Board craft. Sea-going vessel traffic is confined to the Bassein River itself to Bassein, where cargo transfer is accomplished through lighterage.

(2) Depths and Widths. In the first 46.5 miles of channel above Diamond Island, or to the mouth of the Panmawadi River, there are good depths of water, no sharp bends, and adequate widths for safe and dependable two-way navigation. At the mouth of Panmawadi River a serious shoal occurs which is known as Panmawadi Flats and depths as little as 18 feet M.L.W.S. are encountered. From the mouth of the Panmawadi River to the harbor limits of Bassein, the Bassein River offers a tortuous channel requiring extreme care in the navigation of the larger vessels, and from the mouth of the Thandwe River (Mile 56) the curves are of such short radii as to prevent two-way navigation.

Immediately upstream of Panmawadi Flats, the channel swings sharply inshore at Cockatoo Point and at this point there are rock shoals known as the Ashby Rocks. While not of critical depth, the shoals, plus sharp channel curvature, present difficult navigating conditions.

From Mile 56 to the Port of Bassein the river is narrow and extremely tortuous. There are 9 sharp bends in this reach, 6 of which are of very short radius and extremely difficult to navigate. These are at Deep Water Point, Creek Point, Devils Point, Chanawah Point, Vincent Point, and Hereford Point. In general, the width of the river in the sections between the bends appears to average about 1,200 feet and offers no particular navigation difficulties; however, in the bend areas the width narrows down to about 400 feet, particularly at Creek Point, Devils Point and Chanawah Point. Because of the narrow width of the river, depths in the reach from Cockatoo Point to Bassein are great, usually varying from about 28 to 100 feet, M.L.W. Springs datum.

(3) Mines. No mines were placed by the Allied Forces either in the Bassein River or harbor area.

(4) Wrecks and Other Artificial Obstructions. There are no wrecks which interfere with sea-going commerce. The principal obstructions to navigation are the Ashby Rocks at Cockatoo Point and the shoal areas of Panmawadi Flats.

(5) Navigational Difficulties. There are no particular difficulties encountered in navigating the first 46.5 nautical miles upstream of Diamond Island, or until the river crossing at Panmawadi Flats, approximately at the mouth of the Panmawadi River, is reached. There probably the most critical depth restriction of the entire waterway up to the harbor of Bassein is met and serves as the control point governing the draft of vessels. Depths over this shoal area average:

M.L.W.S.	*M.L.W.N.*	*M.H.W.S.*	*M.H.W.N.*
18.3 feet	19.8 feet	24.3 feet	23.0 feet

Above the mouth of the Thandwe River (Mile 56) the widths of the Bassein River and the degree of curvature of the bends are inadequate for safe and dependable one-way navigation and entirely prohibit any two-way navigation. This section requires extreme care in navigation.

(6) Channel Rehabilitation Activities. Since there were no mine-laying activities on this channel or wreckage impeding sea-going commerce, there have been no rehabilitation measures taken, nor will there be any required, for returning the port to prewar basis.

b. Port, Harbor and Anchorages.

(1) Depths and Widths. Bassein harbor is a section of the Bassein River in front of the city and approximately 3 miles long, beginning about 70 nautical miles upstream of Diamond Island. The average useable width of the river in the harbor area is a little over 1,000 feet; however, there is a great amount of local barge and sampan traffic and anchorage along the river banks, thus reducing the useable anchoring and turning width to about 700 feet. Commercial loading of the larger vessels is carried on in the river from Mile 70 to 71.5, for here the useable width is wider than in the section opposite the city. At the upper limits of the harbor the channel is narrower, reducing in width to about 700 feet of waterway with probably not more than 400 to 500 feet at the most available for turning. Depths are good throughout the harbor area, ranging from about 32 to 85 feet, M.L.W. Springs datum; but loading must be carried on in midstream because of the shoal conditions along the foreshore.

(2) Obstructions. Except for foreshore shoal areas there are no physical wrecks or obstructions which interfere with commerce in the harbor area.

(3) Mooring Buoys and Docks. In the harbor area 7 mooring buoys are maintained for anchoring of large vessels. These buoys are of light type with 5-ton anchors

and probably will have to be replaced with a larger type during maintenance operations, since the larger vessels experience difficulties in mooring. There are 5 floating jetties of variable size, all in poor condition and should be replaced at an early date. There are a great number of wharves and docks for private use. The larger of this type are located at the rice mills along the river.

(4) Warehouses. There are no warehouses at the Port of Bassein available for general cargo. There is one godown owned and operated by S.A.M.B. used principally for storing their own rice and rice products.

(5) Mechanical Facilities. There are no mechanical facilities available for loading, discharging or handling of cargo.

(6) War Damage. There were very little war damages to the port facilities at Bassein. Two pontoons were sunk; however, they since have been removed.

(7) Rehabilitation Activities at Port. Rehabilitation activities are now being carried out locally in connection with the initial post-war maintenance program. It is understood that 4 new pontoons are on order and will replace the old outmoded jetties on arrival.

c. Commerce. Bassein, located about 72 miles up the Bassein River, is the farthest inland seaport in Burma. It also is Burma's second largest port with annual commerce exceeded only by the Port of Rangoon. Situated on the westernmost distributary of the Irrawaddy and in the rich paddy land delta, it thus becomes a natural point of export for paddy, rice, and rice products. It is well served by connecting channels of the delta which provide the avenues of commerce for the country boats, the principal carriers of paddy. It was not until about 1927 that Bassein became a major port. In the 10 years prior to World War II the average annual commerce approximated 315,650 tons. There is essentially no foreign import trade, with the commerce basically export of paddy, rice and rice products. There is also a small trade in teak as well.

In the post-war period, it appears that Bassein is fast regaining its trade with the annual commerce of 1948 estimated at about 221,000 tons and in 1949 about 245,000 tons, or approximately 78 per cent of the prewar average and about 60 per cent of the prewar high of 420,100 tons in 1939-40. Since Bassein so adequately serves the rice commerce, and of course providing that the Bassein Channel is maintained to fulfill the requirements of sea-going navigation, there is no apparent reason why the commerce of the port should not return soon to the prewar level. With further development in land use and in rice culture additional rice commerce will result and commerce at Bassein may increase as much as 25 per cent over the prewar level.

d. Recommendations. In the Port of Bassein there are no major outstanding rehabilitation requirements which have not been accomplished or for which planning is not underway. In the Bassein Channel there are a number of navigational hazards which must be given further consideration. With the depth criteria as set by the Panmawadi Flats and the curvature criteria established by the 9 sharp bends in the upper 20 miles of channel, restricting size of vessels to about 450 feet in length for single screw and 470 feet for twin screw, and navigation on high tide conditions, further study must be given to the feasibility and justification of alleviating these restrictive conditions. Studies should be made of the possibility of eliminating the shoal sections by deflecting dikes as against costly continuous maintenance dredging, and consideration should be given the possibility of the construction of two channel cut-offs which would eliminate most of the sharp bend difficulties.

4. MOULMEIN.

a. Entrance Channel.

(1) The Salween River splits at Moulmein into two channels, both flowing to the Andaman Sea. The westerly flowing channel, also known as the Darebauk River, is used primarily for local traffic; the southerly flowing channel, known as the Moulmein River and the Moulmein navigation channel, is the principal artery of travel for both local and sea-going commerce. The Moulmein channel extends from deep-water near the Goodwin Light (opposite Amherst) to the lower anchorage and lightering area at Moulmein, a sailing distance of approximately 24.5 nautical miles. The mean river level at Moulmein is highest in September when it is about 8 feet above M.L.W. Springs datum and lowest in March when it is about 3 feet above this datum.

(2) Depths and Widths. The bed of the Moulmein River is of the alluvial type, thus the navigation channel both in the bay and river sections is subject to constant change. However, under the same general average annual hydraulic conditions, depths and widths of the navigation channel should maintain the same relative values even though there may be considerable side movement of the channels. Numerous hydrographic surveys are required to maintain channel alignment delineation.

In general, the lower 10.5 miles of the waterway above Goodwin Light can be considered as the bay section, varying in width of favorable depths from over 6,000 feet to 1,700 feet. Depths vary from about 61.5 feet to 23.5 feet M.L.W. Springs. In the remaining 14 miles to the Port of Moulmein depths vary from 20 to 52 feet, M.L.W. Springs datum and widths vary from 400 to 1,600 feet; however, there are critical sections where depths decrease to 17.5 feet M.L.W. Springs and widths to as low as 200 feet.

(3) Mines. The Moulmein channel was mined exten-

sively by the Allied Forces during the past war. In an initial step toward reopening of the port and channel for commerce the navigation channel was swept. Because of the shifting nature of this channel it is necessary to make frequent hydrographic surveys. Although the mines placed in this area may be considered by many to be no longer active, they are potentially dangerous as demonstrated by the detonation of one mine in June 1950 by one of the survey boats. Drafts of vessels are now restricted to 22'-6" by the mine conditions and if further sweeping was accomplished this draft may be increased to as much as 28 feet. To permit proper hydrographic investigations of the waterway and to increase the operating draft of the vessels the entire river should be swept at the earliest practicable date. Before any dredging or other construction operations are undertaken it would be advisable that the mines in the work areas first be removed or detonated.

(4) Wrecks and Other Obstructions. There are no wrecks causing serious difficulties to navigation; however, there are a great number of rock shoal areas which interfere with safe operation of vessels and which require cautious pilotage. The most critical of these shoals should be removed, particularly those which are in or extremely near the navigable section.

(5) Navigational Difficulties. There are three sections of critical navigation problems, in addition to the numerous rock shoals, in the Moulmein channel. The first section is at Amelia Crossing, from 11 to 11.5 nautical miles above Goodwin Light, where deep water suddenly changes from the east to west sides of the river. At this abrupt crossover shoals exist in the center of the river. At Natmhaw, about 19 miles above Goodwin Light, there are serious rock shoals and also abrupt alignment changes in two very sharp curves. In the vicinity of Mile 22, or about 2.5 to 3.5 miles above Natmhaw, there is another shoal area and section of rather sharp reverse curvature. Furthermore, at the entrance to the Port of Moulmein there is a shoal and rocky area known as the Sirocca Rocks. For the remaining sections of the Moulmein River the depths are in excess of the above critical sections. The critical depths under the different tidal conditions are:

	Tidal stage in feet			
	M.L.W.S.	*M.L.W.N.*	*M.H.W.S.*	*M.H.W.N.*
Amelia Crossing	17.5	23.5	36.5	31.0
Natmhaw vicinity	14.0	17.0	29.2	24.0
Mile 22	16.5	17.5	30.0	24.5
Sirocca Rocks	14.5	14.5	26.5	21.5

In general, the width of the Moulmein River navigation channel is adequate for sea-going vessels under good pilotage; however, there are certain sections in addition to the many rock shoal areas, which present hazardous conditions even under good pilotage, and in some instances difficult for even one-way navigation. These sections correspond closely to the section of critical depth and are:

	Width in Feet
Amelia Crossing (Mile 11 to 11.5)	300 Feet
Head of Long Island (Mile 17 to 18)	200 "
Natmhaw (Mile 19)	400 "
Mile 22	400 "

(6) Rehabilitation Activities: Except for the mine-sweeping activities already accomplished in the navigation channel to open the harbor to post-war commerce there have been no other rehabilitation measures taken. Additional sweeping operations are necessary before hydrographic survey operations can be conducted safely and before the movement of the navigation channel can be determined. If it is considered necessary either to remove any of the rock shoals or extend the dimensions of the navigation channels to accomodate the larger types of sea-going vessels, then it probably will be necessary to remove or detonate the mines in the affected work areas.

b. Port, Harbor and Anchorages

(1) Depths and Widths. Moulmein harbor is considered to be that section of the Moulmein River between Mupon Point and Battery Point, a river frontage of about 4 nautical miles, beginning about 24.5 nautical miles upstream of Goodwin Light; however, the lower mile of the harbor is not suitable for anchorage because of the Sirocca Rock shoals. In the harbor, depths vary from about 21.5 to 32.5 M.L.W.S. datum and widths from 1,000 to 3,000 feet. Water of adequate depth does not prevail close enough inshore to permit loading or unloading of vessels from existing wharfage facilities and cargo transfer is accomplished through use of lighter-barges and sampans directly to and from the ship while in anchorage.

(2) Obstructions. The Sirocca Rocks shoal area, in addition to being one of the critical depth sections on the waterway, also limits the anchorage areas at the port. One of the early phases of waterway modifications which would be required by the use of larger ships and by increased commerce requirements would be the removal of these shoals. Other sections of alluvial shoals are in the harbor area and would have to be removed also. There is no wreckage in the harbor area which affects navigation adversely.

(3) Mooring Buoys and Docks. There are 8 mooring buoys in use at this time, including the two buoys received under the E.C.A. program. All of the buoys are in the anchorage fronting the City of Moulmein. At present there is a 175-foot (13 unit) cargo pontoon which is being replaced by a 40′ x 250′ pontoon under the E.C.A. program. In addition, there are two small floating jetties and one floating barge. The barge will be replaced by the cargo pontoon when it in turn is replaced by the new 250-foot pontoon. There are a great number of small private docks for loading sampans and barges. Each of the river-side rice mills has a cargo handling pier. These and the

private docks in general are of very light construction and are not available for general cargo handling.

(4) Warehouses. At present there are only two small godowns at this port available for general cargo. These are located adjacent to and in connection with the cargo pontoon. Three new rice godowns have been constructed by the State Agricultural Marketing Board at Mupon, on the outskirts of Moulmein, for their own use.

(5) Mechanical Facilities. There are no mechanical facilities available for the handling of general cargo at Moulmein.

(6) War Damage. The City and Port of Moulmein were subjected to heavy bombing by the Allied Forces during the past war, but the city suffered the greater damage. At the port 4 pontoons, 2 bridges and the godowns were lost. The damaged structures at the port have been removed; however, these pontoons have not yet been replaced. Since they are the principal access for small boats and barges, early replacement is advisable.

(7) Rehabilitation Activities at Port. Removal of damaged structures which would interfere with commerce has been completed. Two mooring buoys and a 40′ x 250′ pontoon are being installed through E.C.A. aid and other minor rehabilitation measures are being accomplished under the normal maintenance program.

c. Commerce. Moulmein, an important center for the rice and teak trade, is an inland port, being about 25 miles from the sea. The Salween River, splitting at Moulmein into two outlets of which one, the Moulmein River, forms the commercial entrance channel, flows through country abounding in teak and rafts of this product are floated to Moulmein. In the tidal area of the Salween and its downstream tributaries, the Donthami, Gyaing, and Ataran Rivers, in a semi-circular area of 50 to 70 mile radius, are the productive paddy lands which are the source of rice commerce. There also are some rubber plantations in the area. Moulmein had a consistently high commerce prior to World War II, and in the fiscal year 1939-40 with its total commerce of about 254,100 long tons it ranked as the No. 3 port of Burma, replacing Akyab's position that year. From 1924 through 1941, the commerce averaged about 168,000 long tons annually, varying from a low of about 134,250 tons in the fiscal year 1925-26 to a high of 254,100 tons in 1939-40.

Since Moulmein is the principal port, for an extensive paddy section, it will retain its high tonnage of paddy, rice and rice products trade. With further development in land use and rice culture, an increase of about 25 per cent in rice trade probably will be realized. The rubber trade probably will increase by an even larger percentage. The traffic in teak probably will not change materially with only a 10 to 15 per cent increase because of increasing difficulties in transporting the logs to the Salween. Imports will depend on the domestic and industrial needs of the area and, as the Moulmein section becomes more developed, the tonnages will increase.

In the breakdown for commerce during 1949, the annual tonnage of 165,398 long tons, for both the foreign trade and coastwise trade, is recorded. This indicated that the harbor at that time had approximately returned to the prewar average, but still lagged about 35 per cent from the prewar high. The breakdown of the 1949 commerce, in long tons, is as follows:

	Foreign Trade	*Coastwise*	*Total*
EXPORTS			
Rice and Rice Products	83,322	853	84,175
Timber	21,189	1,256	22,445
Rubber	2,194	426	2,620
General	3,499	19,943	23,442
Subtotal	110,204	22,478	132,682
IMPORTS			
Coal	2,092	———	2,092
Petroleum Products	7,158	———	7,158
General	1,699	21,767	23,466
Subtotal	10,949	21,767	32.716
TOTAL	121,153	44,245	165,398

d. Recommendations. In the Port of Moulmein there are no major outstanding rehabilitation requirements which have not been accomplished or for which planning is not underway. In the Moulmein channel there are numerous rock shoals and three sections of critical navigation problems, relative to critical depths and widths of waterways. The Moulmein River is alluvial and the thalweg is highly meandering in much of its length, thus requiring continuous hydrographic surveys and shifting of buoys to follow the sailing course. This channel was heavily mined during the past war and until the river has been swept satisfactorily, it appears that difficulties will be experienced both in the hydrographic work as well as actual navigation and maintenance dredging. The sections of critical depth should be dredged at the earliest practicable date. Rock shoals should be removed. Therefore, it is recommended that maintenance dredging and removal of rock shoals, mine sweeping, and hydrographic surveys be carried out as soon as practicable.

To minimize the requirements of maintenance dredging there is a possibility that deflecting dikes or training walls may be used; therefore, further studies should be made relative to channel stabilization.

5. TAVOY

a. Entrance Channel

(1) The City and Port of Tavoy are located on the Tavoy River about 35 nautical miles from deep-water and about 32 miles upstream of Reef Island Light, the beacon designating the entrance to the waterway. For sea-going vessels the waterway is navigable for a distance of about 7.5 miles above Reef Island; however, ships seldom proceed or anchor beyond the series of rock shoals located

1.5 miles farther downstream or about 4 miles above Reef Island.

(2) Depths and Widths. From Reef Island to the anchorage area the minimum depth is approximately 29 feet M.L.W. Springs, 45 feet M.H.W. Springs or 40 feet M.H.W. Neaps. In the anchorage area the widths are of large magnitude, and to this point there would be no navigational difficulties. From the anchorage area to Tavoy the river is very sinuous, shallow, and difficult to navigate even with small local craft. While depths will vary from 6 to 24 feet M.L.W. Springs, 22 to 40 feet M.H.W. Springs, and 17 to 35 M.H.W. Neaps, making it possible for some vessels to transit the river under high-tide conditions, because of the sinuousity of the channel, shifting channels in the alluvial bed, and obstructions, it is inadvisable to attempt to navigate the river with any craft except small motor craft, barges and sampans. Furthermore, depths at Tavor during low tide conditions are as small as 2 feet, thus eliminating suitable anchorage. There are no mooring buoys established in the anchorages.

(3) Mines. During the past war the entrance to the Tavoy River as far upstream as 8 nautical miles above Reef Island was extensively mined by the Allied Forces. While the seaward channel has been swept, thus permitting safe access for navigation to the anchorage area, the mines still can be considered as active and subject to detonation during dredging or striking with anchors; therefore, before any dredging or other construction operations are undertaken it would be advisable that the mines in that area first be removed or detonated.

(4) Wrecks and Other Obstructions. The only obstructions in the Tavoy River estuary are the rock shoals at about 4 nautical miles and at 6 to 7 miles above Reef Island. Were these shoals removed free access then would be available to vessels as far as about 11 miles above Reef Island; however, the additional 5 miles of waterway would hardly be commensurate with the cost and no particular advantage to shipping would be obtained.

(5) Navigational Difficulties. As long as the head of deep-water navigation is maintained at the present anchorage about 4 miles above Reef Island there are no navigational difficulties to sea-going types of vessels. Because of extremely adverse river conditions the sea-going vessels do not proceed above the anchorage areas. Small craft, barges, and sampans transit the river to Tavoy; however, because of extreme river sinuosity, changing river bed conditions, difficult current conditions, even small craft experience difficult navigating conditions.

(6) Rehabilitation Activities. Except for the minesweeping activities already accomplished there are no other rehabilitation measures required for navigation. If it is considered necessary to remove the rock shoal areas or extend the waterway by dredging then it probably will be necessary to remove or detonate the mines in the affected areas.

b. Port, Harbor and Anchorages.

(1) Depths and Widths. The harbor and anchorages for sea-going traffic is in the Tavoy River estuary as described in the preceding discussion. Depths, widths, and anchorage areas are adequate. The Port of Tavoy itself is at the city proper about 26 nautical miles above the deep-water anchorages; however, it is limited entirely to shallow-draft and local riverine traffic. Depths at Tavoy are variable and may be as low as 2 feet during low tide. While the watershed of the Tavoy River is relatively small in area it is located in a zone of extremely heavy rainfall, thus excessive river currents are present in the harbor during and immediately following the monsoon season.

(2) Mooring Buoys and Docks. There are no mooring buoys at Tavoy nor commercial wharves. There are numerous private wharves for loading sampans and barges, principally in connection with the rice mills.

(3) Warehouses. There are no public warehouses or facilities for storage of general cargo. All storage facilities are private and appurtenant to the rice mills.

(4) Mechanical Facilities. There are no mechanical facilities available for handling of general cargo at Tavoy.

(5) War Damage. While Tavoy was subjected to considerable damage from bombing by Allied Forces during the past war there remains very little riverside damage not repaired or requiring repair.

(6) Rehabilitation Activities at Port. No further rehabilitation measures appear necessary for water transportation facilities.

c. Commerce. Tavoy is one of the minor seaports of Burma. It is located about 35 nautical miles up the Tavoy River; however, hydraulic conditions require that seagoing vessels anchor in the estuary. The river permits navigation by launches and country boats only and all transfer cargo is accomplished at the anchorages through lightering. Prewar statistics on waterborne commerce at Tavoy are not available; but it is known that the principal commodities exported included rice and rice products, timber, charcoal, dried betel nut, tin and wolfram ore, dried fish, and rubber. Principal imports include machinery parts, sugar, textiles, oil, tinned provisions, stationary, grocery goods, sundry products, and P.O.L.

At present, only a single ocean-going vessel, the S. S. Matang, 769 tons, of the Straits Steamship Company, calls regularly at Tavoy, both northbound and southbound, operating between Rangoon and Penang on a schedule of one round trip about every three weeks. In the postwar period, the following vessel count is noted:

	Inbound Cargo		*Outbound Cargo*	
	Ocean	*Coastwise*	*Ocean*	*Coastwise*
1947	47	367	54	359
1948	55	309	61	312
1949	62	384	49	267

The following commerce, both seagoing and coastwise, expressed in long tons, has been recorded for the past two fiscal years:

	1949-50	1950-51
EXPORTS		
Rice and rice products	2,557 tons	11,285 tons
Wolfram, Rubber, Tin, etc.	9,362 tons	9,800 tons
Passengers (out)	3,526	1,276
IMPORTS		
General	7,126 tons	8,917 tons
Passengers (in)	3,851	1,624

Since the Port of Tavoy serves a rather restricted area of low potential agricultural use the future tonnages in agricultural and forestry products, including rubber, probably will continue low. Any appreciable increase in export commerce will depend on the development of natural resources and minerals in the trade area. These developments, including incidental industrial development, will also increase imports.

d. Recommendations. In the Port of Tavoy there are no major outstanding rehabilitation requirements which have not been completed or for which planning is not underway. In the Tavoy Channel a great deal of difficulty is experienced by the launches and country boats and the alleviation of these conditions would be desirable. Also the rock shoals in the anchorage areas might well be removed.. However, it is doubtful whether any more than minor maintenance dredging is warranted under present trade conditions. Since the river channel is alluvial and meandering there is the possibility that much of the unsatisfactory conditions could be alleviated by use of training walls and further study should be made as to the feasibility and justification of such works.

6. MERGUI.

a. Entrance Channel.

(1) The Port of Mergui is located on a tidal cutoff connecting the mouths of the Great Tenasserim and Kyaukpya Rivers. The north entrance to the channel serves as access for seaborne traffic, the south entrance principally serves the Great Tenasserim River. Along the navigation course the distance from the harbor to deep-water at sea is about 4 nautical miles.

(2) Depths and Widths. Approaching the light buoy off of Kalwin Point the depth decreases rapidly until the critical depth of the waterway is reached near the light buoy. In general, the depths in the remaining 3 miles of the waterway are only slightly greater than the critical depth. Critical loading conditions will be governed by the following:

M.L.W.S.	M.L.W.N.	M.H.W.S.	M.H.W.N.
11.1 feet	16.9 feet	27.9 feet	22.5 feet

From the light buoy to Mergui the navigation course closely follows a series of depth pockets which average, at the 2-fathom contour, M.L.W.S., about 200 ft. in width. Fortunately these pockets are in regular alignment and the sailing course is in more-or-less two straight lines.

(3) Mines. During the past war both entrances to the Mergui channel, the two main sea approaches, and the general waters between Mergui and King Island, were extensively mined by both the Allied Forces and by the Japanese. Some sweeping has been accomplished in the north entrance to the Mergui channel and in the Great Tenasserim entrance. While all of the remaining mines must still be considered as potentially active they are not interfering with the present type of lesser-draft vessels operating on the waterway; however, before any channel and harbor work can be carried out either for maintenance dredging or developing the port for larger vessels, it would be advisable first to remove these hazards in the sections to be worked.

(4) Wrecks and Other Obstructions. In the vicinity of the Kalwin light in the north entrance area there are 3 or 4 wrecks and obstructions. Another obstruction lies in the channel about 1 mile from Mergui. A large number of sampan hulks and wrecks line the bank between Mergui and Kalwin Point. At the south entrance, or in the entrance to the Great Tenasserim River, there is a wreck which is a menace to navigation. With the presently-used sailing courses these wrecks and obstacles do not interfere materially with navigation except the wreck at the south entrance. If the harbor and channel are developed and dredged to accommodate larger vessels then some of these obstacles will have to be considered.

(5) Navigational Difficulties. Because of the deep-water approaches to the Mergui channel and of only the two straight courses of sailing, adequately marked by range beacons, no difficulty is encountered by small vessels in fair-weather or daylight navigation on favorable conditions of tide. Pilot service is not used. Although the Mergui channel is in the delta of the Great Tenasserim River system, and thus is alluvial, the banks are relatively well defined and depth and width conditions of the navigable channel do not change materially from year to year. Depths and widths of channel are restrictive to seagoing commerce and even under the most favorable tidal conditions could not be used by the larger type of cargo vessel. Under normal operations the channel presently requires maintenance dredging.

(6) Rehabilitation Activities. The only channel rehabilitation measures taken has been minor sweeping of the mine fields to permit passage of smaller vessels. Maintenance rehabilitation of light buoys or other navigational aids has been carried out. No dredging has been accomplished. When a dredging program is initiated for this channel the wrecks and obstructions in the vicinity of Kalwin light should be removed.

b. Port, Harbor and Anchorages.

(1) Depths and Widths. The Port of Mergui can be considered as the section of the channel opposite the entire city for a distance of a little over 1 nautical mile. A seawall approximately 4,000 feet long flanks the city; however, for distances of 200 to 500 feet out from this wall shoaling has been of such extent that the mud flats are exposed at lower tidal stages. Little use can be made of this area for commerce except by very small craft, barges, and sampans during high-tide periods. The deeper-water portion of the harbor and anchorage varies in width from 1,500 to 3,000 feet and in depth from 18 to 60 feet M.L.W.S., thus providing a favorable basin both for anchorage and for lightering provided the number of sea-going vessels in port at one time does not exceed 3 or 4. Tidal currents are strong in this area and during high flows of the Great Tenasserim River extreme ebb currents are present.

(2) Obstructions. Except for the shoal areas in the channel and foreshore areas there are no physical obstructions or wrecks which interfere with port operations except the wreck of the large vessel at the entrance to the Great Tenasserim River, the sunken pontoon at the Main Wharf, and the crane at the Naukte Jetty. The wreck of the vessel not only interferes with river commerce to Mergui, but is in the most desirable anchorage area of this port. The wrecks of the pontoon and crane interfere with small vessels, local, and lighter-craft operations. For freedom of operation of this port these principal obstructions should be removed.

(3) Mooring Buoys and Docks. There are no mooring buoys used in the operation of this port. The two principal wharves, Main Wharf and the Naukte Jetty, were so damaged by war activity that major rehabilitation of the structures and facilities are necessary. Numerous small piers and jetties existed along the seawall prior to the war but were destroyed. Numerous light small private docks are in existence for loading sampans and barges. Each of the rice mills in the area has its cargo handling pier. These and the private docks in general are of very light construction and are not available for general cargo handling.

(4) Warehouses. There are no general cargo warehouses at this port.

(5) Mechanical Facilities. Since the destruction of the Naukte Jetty crane a light caterpillar crane has been used. No other general cargo handling facilities are available.

(6) War Damage. The main war damage at the Port of Mergui was the destruction of all dock-side facilities, all warehousing and custom facilities.

(7) Rehabilitation Activities at Port. The principal rehabilitation activities carried out to date have been the removal of the damaged structures along the seawall. The sunken pontoon and the crane are being removed. The pontoon at Main Wharf is being replaced through E.C.A. aid. Structural damage to the Naukte Jetty will require rehabilitation to restore it to safe operating conditions. Port, customs, and warehousing facilities should be restored, a new crane installed on Naukte Jetty with probably increased length added to the jetty, and the wreck removed from the entrance to the Great Tenasserim River.

c. Commerce. While Mergui had been one of the minor ports of Burma prior to World War II, since the war, and particularly in the last two fiscal years, it has shown a marked increase in activity with commerce in 1950-51 being about twice the estimated high for the pre-war period. The principal commerce at Mergui includes rubber, tin, and ngapi. Minor products include dried fish, dried prawns, rice, onions, chillies, tamarind, dhall, and salt.

The following commerce, both seagoing and coastwise, expressed in long tons, has been recorded for the past two fiscal years:

	1949-50	1950-51
Exports	19,989 tons	25,163 tons
Imports	14,185 tons	23,911 tons
Passengers—out	2,530	1,653
Passengers—in	3,458	1,562

Because of the increase in rubber production and activities in the production of tin it is expected that the commerce at Mergui will double the 1950-1951 commerce in the next 3 to 5 years. Any further material increase in the development of the natural resources of this area will consequently again increase the waterborne commerce.

d. Recommendations. Since Mergui was an important Japanese base of operations during the past war the port was subjected to extensive bombing and all commercial facilities either were destroyed or seriously damaged. The principal rehabilitation measures taken to date have been the removal of the damaged structures along the seawall. The pontoon at Main Wharf is being replaced through E.C.A. aid. The Naukte Jetty was damaged and its repair, plus a new extension riverward of about 50 feet, should be planned and accomplished as soon as practicable. On completion of the Jetty an adequate fixed crane should be installed thereon. New port and customs facilities should be provided as well as one or two small warehouses. Because of the remote location of the harbor and the lack of marine repair facilities, it is desirable to install a small slipway capable of taking craft up to 30 tons deadweight. The wreck in the Great Tenasserim River at the Mergui entrance is a hazard to navigation and its removal, now contemplated through local salvage resources, is recommended.

7. SUMMARY OF PORT REHABILITATION

a. E.C.A. Assistance. The following table shows the items for which funds have been provided by E.C.A. for

rehabilitation of the deep seaports other than Rangoon. The large pipe line dredge being purchased is provided with a power-driven cutter head for use in hard materials and should be of value not only in maintenance or rectification of entrance channels to ports, but also would be available for maintaining the depths in harbors or inland waterways.

TABLE VI
FUNDS PROVIDED BY E.C.A.
for
OUTPORT REHABILITATION

E.C.A. Doc.	*Port*	*No.*	*Description of Item*	*Estimated Cost*	*PRESENT STATUS Procurement Authorities & Purchase Requisitions*
P.P.-8 (Revised) CPR—1	Akyab	2	Mooring Buoys	$ 10,600	$95,000
	Moulmein	2	Mooring Buoys	10,600	
	Moulmein	18	Channel Buoys	57,600	
			Transportation	15,760	
			Total	94,560	
CPR—2 (Revised)	Mergui	1	Floating Pontoon Jetty (complete) (250′ x 40′)	135,000	315,000
CPR—3	Moulmein	1	"	135,000	315,000
CPR—4 (Revised)	All Outports	1	Sea-going Hopper Dredge	600,000	1,785,000
CPR—5 (Revised)	All Outports	1	Pipe Line (18") (22" suction) Dredge	1,185,000	
Total E.C.A. Funds for Outport Rehabilitation				$2,149,560	$2,510,000
Total E.C.A. Funds for Rangoon (See Table 4)				2,344,906	2,449,000
Total E.C.A. Funds for all port rehabilitation				$4,494,466	$4,959,000

From the foregoing table it is noted that nearly $5,000,000 has already been furnished by E.C.A. for rehabilitation of the ports in Burma.

b. Recommendations on Ports.

(1) Projects Recommended for Immediate Development.

(a) The following items recommended by the Port Commissioners of Rangoon as listed in their Program of December 24, 1951 (see Appendix A):

Item	*TOTAL COST Total Rs. Lakhs*	*Purchased Outside Burma U.S. $'s*	*Local Rs. Lakhs.*
I. Flotilla			
(a) 1 Buoy Vessel	50.0	$1,050,000	—
II. Wharves & Equipment			
(a) Roads and Rail Tracks	2.5	20,000	1.5
(b) Ancillary Buildings	9.0	95,000	4.5
(c) Mechanical Handling Equipment	12.0	252,000	
III. Godowns & Other Buildings			
(a) Stores and Workshops Bldg.	5.0	—	5.0
IV. Miscellaneous			
(a) Engineering & Workshops Plant	4.0	84,000	—
Sub-Total	82.5	$1,501,000	11.0
(b) Complete restoration of the Main Wharf and Stone Pier and warehousing facilities at Akyab		now under way using available local funds	
Procurement of two additional cranes for the Main Wharf—Estimated Cost		36,000	
(c) Repairing and extending the Nakte Jetty including the installation of an adequate crane thereon; Port Office and Customs House; storage warehouse; and slipway for the Port of Mergui. Estimated Cost		30,000	6.0
(d) Removal of wrecks and rocks: one wreck in the anchorage in the Tenasserim River at Mergui. Three in or near Rangoon Harbor, (see par. B-1-b-(2) above). Rocks in Moulmein River. Total Estimated Cost....			3.0
(e) Complete the removal or detonation of mines in the unswept areas in the approaches to Rangoon, Moulmein and in areas to be dredged in Mergui harbor, to be done by the Burma Navy. Estimated cost		—	—
(f) Dredging in Akyab and Mergui harbors, and in the approaches to Bassein and Moulmein harbors. Estimated Cost of Surveys			1.5
Total Estimated Cost of (1)		$1,567,000	21.5

(2) Projects Recommended for Comprehensive Study and Investigation (in order of priorities):

(a) Study the foundation conditions at berths 5, 6 and 7, Sule Pagoda Wharves, with a view to determining whether it is economically feasible to reconstruct these wharves for commercial use, and if not what plans for their use are most practical.

(b) Study for improving the foreshore at Lanmadaw so as to relieve congestion of inland traffic in that part of the Port of Rangoon.

(c) Preliminary study of the improvement of Bassein River with a view to straightening and widening the approaches to the Port.

(d) Preliminary study of the improvement of Moulmein River by regulatory works to stabilize the channel.

(e) Study the need for, the estimated cost, and the port charges which might produce revenues to provide for all items on the Program submitted by the Port Commissioners of the Port of Rangoon which are not included in the "recommendations for immediate development" in sub-paragraph (1) above.

(f) Prepare a general plan for the expansion of the Port of Rangoon to accommodate the estimated increase in commerce which should develop in 1959 after the present internal disturbances are terminated, and the resources of Burma have been developed as envisioned in this report.

(g) Preliminary study of the need for a graving dock in the Port of Rangoon; its size; location; estimated cost and time to build; and economic justification.

(h) Investigate and report on the economic feasibility of Government-owned and operated vessels for coastwise service among ports on the Burma coast.

(i) Investigate and report on the economic feasibility of a Government-owned and operated maritime fleet for foreign commerce.

C. INLAND WATERWAYS.

1. GENERAL.

a. General Description of River Systems. Burma consists of a series of river-valleys running from north to south divided from each other by mountain ranges and plateaux. The division of Burma by the watersheds of these rivers, expressed in per cent, is:

Irrawaddy and Chindwin Rivers	55.03 per cent
Salween River and tributaries	18.42 per cent
Sittang River	5.37 per cent
Kaladan River and tributaries	3.75 per cent
Rangoon River and tributaries	2.95 per cent
Great Tenasserim	2.69 per cent
Minor coastal streams	11.79 per cent
	100.00 per cent

Only the Irrawaddy and Chindwin Rivers can be considered as the principal avenues of riverine commerce because of physical characteristics, and fortunately the drainage area of this system represents about 55 per cent of Burma. This river system traverses Burma's most fertile lands and forms the main highway of commerce. The delta region, which is one of the grea: rice granaries of the world, is widely interspersed with distributaries, creeks and branches, forming an elaborate system of inland waterways, which are practically the only avenue of passenger trade and commerce in this region.

The next largest system, the Salween, while representing over 18 per cent of the area of Burma, does not now offer a satisfactory means of commercial transport because of adverse rapids and shoal sections. This river is navigated commercially only for a short distance of 55 miles; however, with its principal coastal tributaries, the Donthami, the Gyaing, and the Ataran Rivers, it offers about 250 miles of navigable waterway in the Moulmein area.

The third central river system, the Sittang River is relatively small, with a drainage area of only about 5.4 per cent of the area of Burma; however, this river lies within an area of high agricultural use. With the Pegu-Sittang Canal, river transportation is possible during the rains in spite of the extreme "tidal bores" in the lower reaches of the river.

The next largest system is the Kaladan River which drains about 3.8 per cent of the area of Burma. Separated from the Irrawaddy by the Arakan Yoma, this system, in conjunction with the Mayu, An, Taungup, and Sandoway Rivers and the chain of coastal islands between the mouths of the Kaladan and Sandoway Rivers, forms a separate unit of riverine commerce and it is in this unit that the Arakan Flotilla Company are the principal operators. The delta area of the Kaladan is a maze of waterways and the basic mode of travel is by boat.

The Rangoon River and its principal tributaries, Pazundaung Creek, Pegu River, Hmaw Wun Creek, and the Pegu-Sittang Canal, while small in area drained, probably is the most important river in Burma from the standpoint of water-borne commerce, for on its north bank is located the City of Rangoon, from which stems over 85 per cent of the sea-going commerce of Burma.

The Great Tenasserim River, upstream of the seaport of Mergui, suffers badly from floods; however, it is navigable to the head of tidewater, about 65 miles above Mergui. As in other parts of Burma, the river is the principal avenue of travel and commerce.

Other minor rivers, such as the An, Taungup, Sandoway, Bilin, and Tavoy Rivers, included in the general remaining drainage area of Burma amounting to about 12 per cent, are all navigable within tidal limits.

b. Commercial Aspects. In general, the inland waters of Burma, where commercial transportation could be maintained, are:

(1) Irrawaddy River and tributaries.
- Henzada to Bhamo, 776 miles, throughout year.
- Bhamo to Myitkyina, 105 miles, 7 months each year.
- Irrawaddy Delta, throughout the year, about 1,500 miles.
- Chindwin River from Pakokku to Homalin, 397 miles, throughout the year.

(2) Rangoon River and tributaries.
- Rangoon River, 100 miles from sea.
- Pazundaung Creek, 50 miles on tide.
- Pegu River, 48 miles on tide.
- Pegu-Sittang Canal, 38 miles.
- Hmaw Wun Creek, 42 miles on tide.

(3) Sittang River, 155 miles for 3 months, 25 miles all year.

(4) Moulmein Services (Salween River and tributaries).
- Salween—Moulmein to Shwegun, 55 miles.
- Donthami—60 miles on tide.
- Gyaing—38 miles throughout the year.
- Ataran—64 miles throughout the year.

(5) Tavoy River—62 miles throughout the year.

(6) Great Tenasserim—65 miles on tide.

(7) Arakan Coast.
- Mayu River—64 miles on tide.
- Kaladan-Lemro Rivers and tributaries—347 miles and more on tide.
- An, Taungup, and Sandoway Rivers—in tidal range.

(8) Other coastal streams in tidal range.

c. Effects of Rainfall. Hydrologic conditions have a great effect on the commerce on the rivers of Burma since rainfall is distributed between two major seasons, the monsoon and the dry season, and not more uniformly distributed month-by-month as in many other sections of the world. Rivers of the Tenasserim and Arakan sections carry the runoff of annual rainfall often exceeding 200 inches and, since the bulk of this rainfall occurs in the months of June, July and August and inasmuch as the topography of the watersheds is rugged, extreme variations between low and flood stages occur. These stage differentials may vary up to 71 feet as experienced on the Kaladan River in 1929. Even on the Irrawaddy, whose upper drainage area is in a relatively low rainfall zone, rises of over 39 feet have been experienced at Bhamo in 1947 and average annual variations of 33.5, 31.7, and 37.3 feet are realized at Bhamo, Mandalay, and Prome, respectively. Except for the Chindwin, Irrawaddy, and Salween Rivers whose headwaters stem from the snow-capped mountains of north Burma and Tibet, the base flows of the rivers of Burma are very low, providing little navigation upstream of the tidal effects, except during short periods in the rains. Since topographic features prevent navigation on the Salween for commercial craft above Shwegun, the only major avenues of riverine commerce during the "dry" season then become the Irrawaddy and Chindwin Rivers. Fortunately these rivers traverse the heart of Burma and consequently are of extreme importance in the economy of the nation.

d. Tidal Effects. All of the other rivers of Burma, as well as the Irrawaddy and Salween, flow to the sea; therefore their lower reaches and deltas are in the tidal influence. These tidal conditions, or the difference between Mean Low Water Springs and Mean High Water Springs tides, vary approximately as follows:

Mouth of Kaladan River (Akyab)	7.3 feet
Mouth of Bassein River (Diamond Island)	6.3 feet
Mouth of Rangoon River (Elephant Point)	18.0 feet
Mouth of Salween River (Amherst)	19.0 feet
Mouth of Tavoy River (Reef Island)	15.5 feet
Mouth of Great Tenasserim (Mergui)	16.8 feet

It can be seen that in the tidal influence many of the water courses can be navigated on favorable tide conditions. In the Kaladan-Lemro and Irrawaddy River deltas, which includes nearly 12,000 square miles of the rich paddy lands of Burma, the maze of distributaries, streams, and chaungs have permitted over 2,000 miles of commercially navigable watercourses and thousands of miles of other channels which have been used by country boats. In the lower reaches of the Mayu, Pegu, Sittang, and Salween Rivers, these favorable tidal conditions permit the movement of the rice from these developed paddy areas to mill and market by both commercial and country craft. Of the estimated 5,000 miles of inland waterways of Burma which have been used commercially, over 4,000 miles lie within the tidal influence.

2. RIVER SYSTEMS.

a. Irrawaddy River.

(1) The Irrawaddy River, rising in the mountains which form the northern boundary of Burma, flows in a north-south direction traversing the most fertile lands of the country. The river can be classified as of three types:

(a) The non-navigable section from the headwaters to the vicinity of Myitkyina where rapids and velocities prevent navigation of other than local native craft.

(b) The main river section which may be divided into two parts: one, the section from Myitkyina to Bhamo where navigable conditions are available for about 7 months each year; and two, from Bhamo to Henzada, where navigation is available for the entire year.

(c) The delta section begins at about Henzada where the Irrawaddy breaks into distributaries, creeks and rivulets.

Navigation conditions are different in each of these three areas, and especially in the shallow creek-like channels in the delta section.

(2) Rise and Fall of River. On the main river above the delta region there is considerable variation between the low and high water stages. The average of these maximum variations are 33.5 feet at Bhamo, 31.7 feet at Mandalay, and 37.3 feet at Prome. The difference between maximum high-water stage at Bhamo (July 1946) and minimum low-water stage (Feb. 1947) was 39.2 feet. The highest stages occur from June to September. After the last rise in September or October, the river falls rapidly through the latter part of October and gradually then through November, December, January, February and in March usually reaches its lowest stages. In April and May, depending of course on the rains, the river is on the rise. In general, from December to March the river is 0 to 5 feet above the lowest level, and from mid-June to mid-October, the river is from 20 to 30 feet above the lowest level and it is usually necessary to have separate high- and low-water landing points at the riverine ports. The maximum rate at which the river rises or falls at Mandalay is about 2 to 3 feet in 24 hours and the rate at Myitkyina is very much higher.

(3) Depth of River. The depth of water at crossings during the low-water season is the greatest single factor limiting the navigability of the river. The lowest levels are usually reached in February and March and the drafts of vessels are then limited to the following:

Rangoon to Prome	5′
Prome to Yenangyaung	4′-9″ to 5′
Yenangyaung to Mandalay	4′-3″ to 4′-9″
Mandalay to Bhamo	3′-6″ to 4′
Bhamo to Myitkyina	2′-6″ to 3′

While the preceding are average critical depths, shoals may be encountered with depths 6 inches less than these minima in all the stretches of river for short periods of one to two weeks when the river is at its lowest level.

(4) Current Velocity. The current velocity varies not only with the season but also with the locality. At Mandalay the speed of the current in the main channel varies from 1.5 to 2 miles per hour during the low-water season to 3 to 4 miles per hour during periods of high-water. During the low-water season velocities of 4 to 6 miles per hour may be encountered in various short reaches between Rangoon and Bhamo and 6 miles in and above the first defile between Bhamo and Myitkyina. During the rains, a current velocity of 8 m.p.h. may exist, but only in very exceptional circumstances. In general, the current velocities between Rangoon and Bhamo can be taken as:

	Average	*Maximum*
Low-Water Season	2 m.p.h.	4 m.p.h.
High-Water Season	4 m.p.h.	6 m.p.h.

(5) Width of Channels. The Irrawaddy River, especially from Bhano downstream, is an alluvial braided stream with constantly changing bars, shoals and channels. The best way to express critical width conditions is to indicate the type of craft which may be navigated in the various sections, for the width of the river at sharp bends limits the length of vessels or the overall dimensions of a tow which can ascend or descend the river. Generally, in the shoal areas on the Irrawaddy very sharp bends and narrow channels are usually encountered.

The dimensions of the large paddle steamers and flats in the prewar period were: Steamers, length 310 and 326 feet, breadth 46 feet to which 30 feet must be added for the paddle boxes; Flats, length 250 feet and breadth 34 feet. Each large paddle steamer on the cargo service from Rangoon to Mandalay normally towed two flats, one on each side, thus the overall length of tow was 310 or 326 feet and the width approximately 144 feet. Normally the vessel with two flats could get through without difficulty and occasionally a vessel could tow 3 flats; however, when the river was at its lowest stages it was sometimes necessary to tow first one flat and then the other through the shoal crossings. Between Rangoon and Mandalay the permissible overall dimensions for a tow of 4 to 4.5 feet of draft during the low-water season are:

Width—Good conditions—200 feet.
Normal—150 feet.
At bad shoal crossing—100 feet with difficulty.
Length—Up to 450 feet in normal or fairly adverse conditions.

Between Bhamo and Myitkyina the length and width of the operating craft are limited by the sharp and narrow bends between rocks in the first defile. Probably the maximum of 150 feet by 50 feet can be set for this section.

Under natural river conditions the above will continue to be the governing dimensions on the Irrawaddy between Rangoon and Myitkyina until rectification measures are taken at the critical sections.

b. Chindwin River. The Chindwin River is the most important tributary of the Irrawaddy River. It is approximately 600 miles long and enters the Irrawaddy near Pakokku by several mouths, the extreme outlets being 22 miles apart.

The Chindwin is considered navigable by steam vessels as far as Homalin, about 400 miles upstream of the mouth; however, launches can reach Tamanthi (57 miles above Homalin) in the rains and small launches can go as far upstream as Singaling Hkamti (123 miles above Homalin) throughout the year. Homalin usually is considered as the head of navigation and the maximum draft up to Homalin during low-water is 2′-6″ to 3′. At Homalin the river is about 500 yards wide.

The Chindwin is not an easy river to navigate and night running, especially in the lower reaches, is very hazardous. The maximum distance which can be covered by steamer in a day is 80 miles upstream or 200 miles downstream. In the cold weather, dense mists occur in the mornings and steamers are unable to sail until the sun is a long way above the horizon. During the high-water season, navigation is not difficult; but, during the dry season the river is navigable only by very shallow draft steamers which frequently run aground on sandbanks. Difficulty is caused by snag areas and shoal water.

At a point about 82 miles above Pakokku is the Shwezaye gorge. In the high-water season this is difficult for downward-bound shipping and, on a high river, steamers could not bring flats through this gorge.

From Pakokku to Kalewa, for the first 70 miles, or to Monywa, the course of the Chindwin is much beset with islands and sandbanks. The land on the east bank is generally flat and subject to flooding during the high-water and in the lower 25 miles the waters of the Chindwin and Irrawaddy often join during the flood stages. On the west bank the hilly country reaches nearer the river. Monywa is built on low-lying ground and protected from inundation by an embankment; however, it has good rail and highway connections with Sagaing and Mandalay. From Monywa to Kalewa, a distance of about 147 miles, the river is tortuous, with a great number of sand and mud flats and several islands.

c. Rangoon River.

(1) General Description. The Rangoon River, otherwise known as the Hlaing or Myitmaka River, with its principal commercial tributaries, the Ngamoyeik River (Pazundaung Creek), the Pegu River, and the Hmaw Wun Creek, along with the Pegu-Sittang canal, forms a small system with respect to drainage area; however, this system is of major importance to Burma from a commercial standpoint. The

City of Rangoon, from which stems over 85 per cent of the sea-going commerce of Burma, lies on the north bank of the Rangoon River, extending from the beginning of the river (confluence of the Hlaing and Panhlaing Rivers) to the mouths of Pazundaung Creek and Pegu River, about 21 miles from the Gulf of Martaban .

The Rangoon River is considered by many to be part of the distributary system of the Irrawaddy; however, it is being considered herein as a separate river system, although it has many connections with the Irrawaddy. From a commercial aspect the principal connections are:

(a) Rangoon to Irrawaddy River via Twante Canal and China Bakir River—58 miles approx.

(b) Hlaing River to Irrawaddy River via Panhlaing River—52 miles approx.

(c) Hlaing River to Irrawaddy River via Kokkawa and Panhlaing Rivers—42 miles approx.

(d) Hlaing River to Irrawaddy River via Bawle, Kokkawa, and Panhaling Rivers—62 miles approx.

(2) *The Hlaing River* is tidal to the village of Hlaing (about 60 miles above Rangoon) which was the terminus of the prewar launch service. From January to March, barges laden with rice sail up and down the river even above Hlaing. For the first 12 miles above Rangoon the river varies from 300 to 500 yards in width then widens to over a half a mile in width but here is much blocked by sand and mud banks.

(3) *The Panhlaing River* which joins the Hlaing River to form the Rangoon River, at the northern limits of the City of Rangoon, during the rains is big enough to carry the largest inland steamers from Rangoon to the Irrawaddy and is in fact the shortest river route to upper Burma but, owing to navigational difficulties has more or less been abandoned as a trade route.

(4) After the confluence of the Hlaing and Panhlaing Rivers, the *Rangoon River,* as it is now called, flows past the City of Rangoon and is joined by the Ngamoyeik River (Pazundaung Creek) and the Pegu River jointly on the east or left bank. The combined waters flow southwards and are joined by the Thakutpin or Bassein Creek on the west and the Hmaw Wun River on the east before entering the Gulf of Martaban. The *Thakutpin or Bassein Creek* forms one of the major connecting links between Rangoon and the Irrawaddy permitting the use of the large riverine steamers. The *Hmaw Wun* permits inland steamers with drafts of 3 to 4 feet to reach Kyauktan (8 miles) and under favorable tidal conditions the town of Thongwa (42 miles); however, for the last 20 miles the course is very tortuous.

(5) The Ngamoyeik River (*Pazundaung Creek*) is one of the four great tidal waterways which serve this district. During the dry season the depth of the river is three feet, 35 miles upstream; here the tidal rise is about 1.5 feet. This river is navigable by launches as far as Hlegu (50 miles) and cargo boats bring great quantities of paddy to Rangoon from the lands adjoining this stream and its principal tributaries which are navigable for country boats some distance on their courses. Pazundaung Creek forms the eastern limits to the City and Port of Rangoon and for the lower 4 miles the banks are lined with private slips, wharves, and jetties. The description of these facilities are included in the port section on Rangoon.

(6) *The Pegu River,* flowing for half its length of 200 miles through dense forests of teak and bamboo and the remainder through well-developed paddy land, is navigable to Tawa (48 miles) at high tide all the year for large launches. In the dry weather it is only about a foot deep at Pegu (57 miles) but in the rains it is deep and navigable up to Pegu for vessels drawing about 6 feet and up to Zangtu (about 104 miles) for large cargo boats and launches. In the dry season it is navigable, at high tide, up to Dabein (29 miles) by vessels drawing about 6 feet. The river is tidal to Pegu in the dry season. A bore about 3 feet high sweeps up the river especially in February, March and April and its effects are felt at Pegu.

(7) *The Pegu-Sittang Canal,* constructed primarily for navigational purposes to connect the Pegu River with the Sittang River in the endeavor to avoid the adverse tidal bore conditions on the lower Sittang River, leaves the Pegu River at Tawa and continues for 38 miles to enter the Sittang River at Myitkyo. There are two locks, one at either end of the canal, at Tawa and Myitkyo. The average depth of the canal is about 7.5 feet. This canal formerly carried very heavy traffic, passenger launches, teak rafts, and cargo boats.

d. Sittang River. This river is one of the larger rivers of Burma, rising in the Southern Shan States and flowing southerly for 350 miles to the Gulf of Martaban; however, it is only for a short distance that it can be considered navigable for commercial vessels. For the greater part of its length it parallels the Mandalay-Rangoon railway. The entrance of the Sittang River, beginning at the town of Sittang and continuing to the head of the Gulf of Martaban (a distance of about 50 miles) is bell-shaped, uncharted, and is entered only occasionally by local craft. The river below the Pegu-Sittang Canal (entrance 10 miles above Sittang) is dangerous to navigation by numerous sandbanks in the delta and by a tidal bore. The Sittang is tidal to about 10 miles above its junction with the canal and is subject to tidal bore up to this 10-mile limit. The bore occurs daily between September and May, and, although normally not presenting much danger to heavier craft, is dangerous to all craft during the Spring tides. Between June and August there is no bore.

Above the Pegu-Sittang Canal the river is navigable to 6 miles above Toungoo (about 155 miles), by craft drawing 4.5 feet, during the rains from mid-July to mid-

October; however, beyond Madauk (25 miles) the navigable channel presents difficulties to others than serangs accustomed to the waters. Government launches reaching Toungoo in the rains and Madauk in the dry season via the canal were approximately 50 feet in length, 15 feet in width, and 4.5 foot draft.

Most of the tributaries of the Sittang are navigable to country boats only a few miles from their mouths during the rains.

e. Salween River.

(1) General Description. The Salween River rises in the Tibetan highlands, flowing almost parallel with the Irrawaddy and traversing the greater part of the Shan States in a succession of deep gorges which are, in places, 3,000 and 4,000 feet deep. Because of the confined course through which it flows there are tremendous differences between high and low water. Throughout the Shan States the average difference is between 60 and 70 feet and in some places, as much as 90 feet. The river enters the Gulf of Martaban by two mouths, one (Darebauk River) 16 miles due west of Moulmein, and the other (Moulmein River) 20 miles south of that port. The latter is the more important and is used by ocean-going ships.

The Salween River, although one of the largest rivers in the world, except in its lower courses approaching its mouth, is unfit for general navigation owing to the numerous rapids and cascades, but it is used for floating down teak logs from the forests of the Shan States, Karenni and Thaton to the teak depot at Kado above Moulmein. There are, however, considerable reaches of the river in the Shan States which can be used by county craft.

For hundreds of miles from its source in the far northern mountains in the east of Tibet, the Salween's channel has been swift, narrow and turbulent; however, at Shwegun, about 80 miles from its mouth and 55 miles upstream from Moulmein, the river opens out into a broad waterway. Launches of about 110 feet in length can reach Shwegun, but in dry weather it is usually necessary to trans-ship from a launch below to a launch above the bar at Minzi, 12 miles below Shwegun. Motor boats and country boats can get up to Meseik, 28 miles upstream from Shwegun in the dry season. North of Meseik the river flows through the "Hatgyi", a series of rapids 22 miles long, and the gorge now is impassable. From Shwegun to the sea the river is encumbered by numerous islands and shoals. The west mouth of the river, the Darebauk River, is so badly silted up that it is no longer used for commercial navigation to the sea.

(2) The principal *navigable tributaries* of the Salween River are the Donthami, the Gyaing, and the Ataran Rivers. All of the tributaries enter the Salween between Shwegun and Moulmein and thus become a part of the Salween traffic pattern.

(a) *The Donthami River* enters into the Salween from the west 15 miles above Moulmein. This tributary follows a very tortuous route and is tidal some 80 miles above its mouth. Barges and 110-foot launches can reach Dayinzeik (32 miles) and on a very high tide can get to I-He (60 miles). From I-He small launches can go upstream as far as Talaingkayan (80 miles).

(b) *The Gyaing River* enters the Salween from the east about 4 miles above Moulmein. This is a broad river, much obstructed by bars and islands, and is tidal throughout its length to Kyondo, about 38 miles upstream. The Gyaing is navigable for shallow-draft launches of considerable size and for country boats throughout the year except occasionally in the dry weather.

(c) *The Ataran River,* and its principal tributary, the Zami River, enters the Salween from the southeast just upstream of Moulmein. The tidal effect extends to Kya-in Seikkyi, about 64 miles upstream. Large launches run to Kya-in Seikkyi all the year round.

f. Great Tenasserim River. For the major part the Great Tenasserim River parallels the coast and is a turbulent stream with rapids extending to approximately the head of tidewater which is about 65 miles upstream from the mouth at Mergui. The river as far as Tenasserim, 45 miles above Mergui and at the confluence of the Great Tenasserim and Little Tenasserim Rivers, is navigable throughout the year for launches and motor boats. These boats are built locally and are about 50 to 60 feet long, 20 feet wide, and load 10 to 15 tons. In the monsoon these boats can go as far as Tagu, about 20 miles north of Tenasserim, but after the rains Tagu can only be reached on a rising tide. Tenasserim town can be reached throughout the year by watching the tide.

The Tenasserim suffers very badly from floods, two or more may occur in the same year and may last a few days or 3 to 4 weeks. The river overflows its banks and at these times boats and steamers wander over the flooded country.

The Little Tenasserim River for nearly its whole length is a mountain torrent; however, it is navigable for small launches in dry weather for about 2 miles above its mouth and in the monsoon season much farther, but the tide must be watched. It is tidal to about 10 miles above its mouth.

g. Mayu or Kalapanzin River. This river is the westernmost river wholly in Burma (the Naf River forms the western coastal boundary). It is about 100 miles long but is navigable only to Paungdawbyin which is about 64 miles from the river mouth. From the sea the entrance to the Mayu is much congested by sand and mud flats and these, plus the coastal exposure, necessitate riverine commerce to use an inter-connecting system of waterways between the Kaladan and Mayu Rivers via Mingan Creek, Sabata Creek, Mozi River, and Laungzin Creek.

The Mayu is navigable for launches drawing 6 feet up to Paungdawbyin at high water but they must return to Maunggyihtaung before the tide falls below ¾ full, and at low tide they can reach Buthidaung. Care is necessary to avoid the shallows at Seinnyinbya where the depth at low tide is about 4 feet 6 inches. Large sampans 27 to 30 feet long are used for transport of paddy to Akyab.

Approximate distances from the mouth of the Mayu River and from Akyab to the above locations and principal ports are:

	Mileage above mouth	*Mileage from Akyab*
Rathdaung	17	34
Kwazon	35	52
Seinnyinbya	44	61
Buthidaung	56	73
Maunggyihtaung	61	78
Paungdawbyin	64	81

h. Kaladan River. The Kaladan River, about 450 miles long and rising in the Chin Hills, flows for the greater length through rugged country creating a turbulent stream. It is a formidable river in the rains, especially in its lower reaches. The normal flood level is nearly 45 feet above the normal dry-weather stage. In 1929, a record flood year, the high-flood level was 71 feet above dry-weather stage. It often rises very rapidly and is then very dangerous.

The tidal effect is felt as far upstream as Paletwa, a distance of about 98 miles from the sea. Coming downstream, the width of the river varies from about ½ mile at Paletwa to over 5 miles in the Akyab harbor, a port-of-call for sea-going vessels. From Paletwa the valley gradually opens up, but it is not until the neighborhood of Kyauktaw (about 60 miles above Akyab) that the paddy land begins.

From Kyauktaw to a point opposite Myochaung, or from about mile 60 to 38 on the Kaladan, the valley is served also by the Yanwa or Thaye Chaung with interconnecting creeks and canals which are navigated by country boats. The Yanwa was navigated by launches of 6-foot draft up to Thayettabin, about 35 miles above the mouth, but because of the sinuosity of the channel boats of under 80 feet in length only could be used.

Entering the Kaladan from the east about 5 miles downstream from the Yanwa, is the *Yan Chaung*, navigable to Kyeyabyin, about 30 miles above the mouth, by the same type of craft as used on the Yanwa.

About 20 miles above Akyab, the *Yo River* enters the Kaladan from the west. This tributary was navigated by launches as far upstream as Kanzauk, about 35 miles above the mouth.

The Kalabon River system enters the Kaladan from the east about 15 miles upstream of Akyab. The Kalabon river is the name given to the lower reaches of a complicated network of waterways, most of which are navigable, south of Myohaung, about 27 miles upstream of the mouth.

The Kywegu River, entering the Kaladan from the east opposite Akyab, is in reality a part of the *Lemro River* which is navigated as far upstream as Panmyaung, about 56 miles from Akyab, by launches drawing 6 feet.

From the Kaladan to the Lemro Rivers, as far upstream as Yanwa Chaung, lies an area of nearly 1,000 square miles of paddy lands, with all rivers on the east interconnected with an extremely complicated system of waterways and chaungs. Since this entire region is within the tidal influence these chaungs are navigated by country boats and the larger waterways will maintain launch service.

3. NAVIGATING CONDITIONS. As may be noted in the preceding discussion there are two types of criteria which govern navigating conditions: first, the critical depth, width and current conditions on the rivers which have a large enough base flow to support navigation either throughout the entire year or for an appreciable portion thereof (example: Irrawaddy and Chindwin Rivers); and second, those (the hydrographic) conditions in the rivers and deltas along the coast where navigation is limited basically to the tidal sections.

On the Irrawaddy above Henzada and on the Chindwin the rivers are straighter even though for the most part below Bhamo, the Irrawaddy may be classified as an alluvial river. A great number of shoals and bars are evident; however, depths over these bars in low water, especially from Henzada to Mandalay, are sufficient to permit use of larger craft.

In the tidal areas and deltas the watercourses are highly meandering, shallow to the extent of being nearly dry during low tides and, because of the heavy silt load carried to the sea by the rivers, contain a great number of bars, snags, and other factors detrimental to navigation. While commerce can be carried over these waterways during most of the year many reaches are limited to "on tide" navigation. Since the coastal conditions are different than the up-river conditions, it is apparent why different types of vessels are used.

Basically, for better navigating conditions and since smaller vessels would be less economical to operate, it appears that improvement of the streams would be in order. On first analysis one would deduce that improvement of up-river waterways (about 1000 miles) could be accomplished either by use of training walls and channel control or by the removal of the critical sections by dredging. On the sections in the tidal zone (about 4000 miles) training walls probably will not be as effective and deepening and straightening of waterways could best be accomplished by dredging.

Because the type of vessel and channel improvement measures are directly connected economically, further study must be made to determine what improvements are

advisable and whether present and potential commerce can be carried at less cost by other types of vessels. Until these answers have been obtained, continued operations must be carried out in the removal of obstructions to navigation, the cost of which is economically justified by the requirements of commerce.

4. RIVERINE CRAFT. The critical depths and widths on the Irrawaddy from Henzada to Bhamo, and the requirements of breasting the strong river currents, necessitated the development of a large cargo-passenger steamer type of vessel, usually equipped either with stern or side paddle wheels, for this section of river. For the Irrawaddy from Bhamo to Myitkyina and on the Chindwin to Homalin the same type of steamer, but smaller in size, was used. These vessels operated either alone or with one or two barges in tow. Steamers from Rangoon to Mandalay varied in size up to 310 and 326 feet in length, 46 feet (plus 30 feet for paddle boxes) in breadth. The flats were usually of 250 feet by 34 feet size. From Mandalay to Bhamo, a smaller boat was used, more in order of 236 feet in length and 30 feet (plus 20 feet for paddle boxes) in breadth. From Bhamo to Myitkyina the river limits the vessel size to about 150 feet in length by 50 feet in width.

In the tidal sections of Burma's rivers different hydrographic conditions persist. The large steamers were not adaptable to the shallow sinuous watercourses and a different type of vessel was used. In addition, much cargo is carried to the ports by country craft and barges and the basic transportation demand was for miscellaneous cargo and passengers. The resultant vessel or launch usually was of the fast, twin-screw, double deck type.

Prior to the War, the *Irrawaddy Flotilla Company* had a fleet of over 600 vessels of all descriptions, ranging from the large Express Steamers to Cargo Steamers, Ferry Steamers, Creek Steamers and Tugs, down to the small Pilot Launches which buoyed the Irrawaddy from Rangoon to Bhamo. Most of this fleet, which operated on the Irrawaddy River and Delta, the Rangoon, the Sittang, and the Salween River in the Moulmein area, was destroyed during the war. After the War, the *Inland Water Transport Board,* an agency of the Government of Burma, which now operates in lieu of the I.F.C. on these rivers has a fleet of over 500 vessels and craft as shown below:

	1939	1947	1950	1951
Moulmein Area	35	46	13	4
Irrawaddy Delta	340	113	188	230
Rangoon-Mandalay	181	179	145	127
Mandalay-Bhamo	11	51	6	32
Chindwin	14	141	128	57
River Conservancy	98	87	54	81
	679	617	534	531

Along the Arakan coast and rivers (the Mayu, Kaladan Lemro, An, Taungup, and Sandoway Rivers) the fleet is owned and operated by the *Arakan Flotilla Company,* a subsidiary of the British-India Steamship Navigation Company. On approximately 1000 miles of waterways the company maintained, prior to the War, 13 double deck passenger launches (275-300 passengers) and 2 single deck passenger launches (150-175 passengers). Since the War, the fleet is composed of 6 double deck passenger launches (275-400 passengers) and one single deck passenger launch (175 passengers). In addition, the Inland Water Transport Board has furnished them with 18 barges (3460 tons) and 6 tugs.

In addition to these major common carriers there are a considerable number of private and contract carriers, especially in the tidal and delta areas.

As compared to the prewar period the riverine service has been materially curtailed, due partly to lack of vessels and partly to insurgent activity. Not only have scheduled operations been reduced drastically but also the watercourses travelled commercially. In the Arakan section it appears that only about two-thirds of the previously navigated channels are used and in the Irrawaddy Delta—Rangoon River section only about one-third.

5. COMMERCE. Although records of prewar cargo and passenger commerce on the inland waterways are not available, estimates of prewar annual commerce by common carrier on inland waterways generally indicate:

	Cargo (tons)	*Passengers*
Irrawaddy Flotilla Co.	1,200,000	8,000,000
Arakan Flotilla Co.	60,000	225,000

These values do not represent the true picture of riverine commerce since there is no report on the commerce carried on by the private and contract carriers and by country boat. When it is realized that much of the paddy crop of coastal Burma was transported to the mill by country boat the tonnages of inland waterway commerce may be as much as 3 or 4 times the amount shown above as indicated by the rice and bran exports from the seaports. The country paddy commerce probably does not directly affect the type of common carrier operating on the waterways as it will continue to be handled in the same manner in the post-war period. The common carrier prewar and post-war derives most of its commerce through dry-cargo packaged commodities; however, the development of the natural resources of Burma, such as coal from the Kalewa area, coke from the mouth of the Chindwin area, and oil from the Chauk and other potential sources, will probably require new types of floating plant for economic bulk transportation.

In the post-war period, for the fiscal year ending 30 September 1951, the following commerce is reported:

	Cargo (tons)	*Passengers*
Inland Water Transport Board	641,242	2,531,057
Arakan Flotilla Company	29,808	140,405

Comparing these values with the estimates of the pre-

war commerce, we note that I.W.T.B. has experienced a 53 per cent return in cargo trade and only about 32 per cent in passenger trade. On the other hand, the A.F.C. appears to have approximately a 50 per cent return in cargo and a 62 per cent in passenger trade.

The slow return to prewar commerce, especially as experienced by the Inland Water Transport Board, is due to a large extent to insurgent activity. Only part of the I.W.T.B. fleet now is in operation and then by traveling during daylight hours only and under military escort, and only about 1/6 of the usable watercourses have service. As soon as it is again safe to operate the fleet there is no reason to believe that within a very short period of time commerce will not only return to the prewar level, but in the following 10 years may be increased by as much as 15 to 20 per cent.

6. RECOMMENDATIONS. Since the inland waterways of Burma are the principal avenues of commerce, and commerce is one of the prime factors in the economy of the country, it is of vital importance that these waterways, and the commercial vessels which ply thereon, be kept in as high operational condition as possible. Because of the present insurgent activity, it is not possible to navigate commercially on more than a low percentage on some of the river systems, especially the Irrawaddy Delta, and not at all on other systems. However, the routes navigated must be maintained adequately for, with both railroads and highways essentially inoperative for transport, riverine commerce must continue. In the same sense, the craft in operation must be kept in good mechanical condition and during transit should be able to contact the dispatchers, riverine stations, maintenance forces, and other craft at all times.

At the cessation of insurgency there will be a sharp and material increase in riverine commerce and in the number of waterways reinstated, and commerce in excess of prewar quantities can be expected. The riverine fleet must be ready to cope with the increased demands; the conservancy forces must be able to open up and maintain the reactivated waterways.

On the Irrawaddy and Chindwin Rivers, the major commercial routes to central and north Burma, critical depth and width conditions prevail, playing a large part in the fixing of vessel type. Time has not permitted an adequate investigation of these rivers, nor the 4,000 miles of waterways in the tidal reaches to determine the feasibility and justification of river control and channel requirements and, because of the importance of this phase of Burma's economic life, complete studies should be made of the waterways.

Therefore, it is recommended that:

a. Maintenance and marking of waterways presently in operation be carried out and that the conservancy forces execute plans for the additional work load which will be required at the termination of insurgent activity.

b. To cope with insurgent activity and to operate properly the dispatching of the river fleet, it appears necessary that radio communication facilities be installed immediately on all commercial riverine craft, freight stations, and conservancy units to permit the safe and efficient operation of the transport systems. Estimated cost is $200,000, plus Rs. 1.25 lakhs local costs.

c. At the cessation of insurgent activity there will be a sharp increase in riverine commerce in excess of prewar tonnages; therefore, the Inland Water Transport Board and other agencies should be required to plan and construct for the increase in vessel and commerce requirements.

d. Based on an economic analysis of the potential riverine commerce, studies should be made on whether the present types of craft used in both the river and tidal sections are best suited for the transport of passenger and cargo commerce. In addition, the relation of transport to the development of new resources should be considered to determine if new fleet requirements are needed.

e. Studies should be continued to determine if waterway improvements are necessary, feasible and justified. To facilitate these operations, aerial photographs should be made during the low-water season to determine the present conditions on the principal waterways. If these photographs are not made in conjunction with the program of the Ministry of Agriculture and Forestry ,the cost of photography probably will be about Rs. 5.0 lakhs.

Appendix A

SEVEN YEAR PROGRAM—PORT OF RANGOON

COMMISSIONERS FOR THE PORT OF RANGOON

NOTE DATED 24th DECEMBER 1951 ON ESTIMATED FUTURE NEEDS OF CAPITAL, WORKS & EXPENDITURE

1. This note deals essentially with rehabilitation works which would need to be undertaken from 1952 to bring the capacity of the Port to prewar capacity, although a brief reference is made to additional capital works which will be needed as soon as trade begins to approach prewar figures. The volume of seaborne traffic which passed through the Port of Rangoon before the war was somewhat over 5 million tons a year. The present volume of traffic is approximately 2 million tons a year. For purposes of the present estimates, it is being assumed that the prewar level will be reached in 7 years from now, that is, by the beginning of 1959, whereas previously the estimate had been 5 years from 1950, that is, by 1955-56.

2. A Statement is attached to this note showing the works that would be necessary, year by year, from 1952 to 1958. The division into yearly programmes also indicates the relative priorities between the various works. In arriving at the estimated costs of the different works an attempt has been made to allow for increases in prices of materials, etc., that have occurred over the past two years. In the succeeding paragraphs, notes are provided on the more important items of expenditure, following the order shown in the Statement.

I. FLOTILLA

3. Buoy Vessel. Before the War the Commissioners had two buoy vessels both of which were sunk as a denial measure in 1942. After the war, at first two and now one vessel is in operation. This vessel, on hire from the British Admiralty, is unsuited to the climate and the working conditions in Rangoon, is in poor condition and expensive to maintain, and is liable to be withdrawn by the owners at any time. The commissioners are in need of one buoy vessel immediately and another buoy vessel from about the fourth year when the number of moorings, etc. would have increased and would have become well beyond the capacity of a single vessel to maintain.

Survey Vessel. The Commissioners have lost two survey vessels by mines. It has been possible to do without replacements because all river survey operations outside of the mineswept channel were stopped after the second accident. It has now been declared in a British Admiralty Notice to Mariners that the Rangoon River can be considered safe and a survey vessel has become urgently necessary to resume survey operations. Practically all plans and charts of the river outside of the original mineswept channel are out of date.

Heave-up Boats. These are required to replace existing ones of prewar construction and to cope with the additional number of buoys and moorings that will come into commission.

Harbour Launches. These are required to replace launches obtained second-hand from the Army after the war which are nearing the end of their useful life.

Work Barges. These are used for engineering works in the river and are needed to replace existing barges of prewar construction.

Tugs. These would be required to cope with greater activities on the river.

Bucket Dredger. The Commissioners have at present 4 grab dredgers for dredging near the wharves and along the foreshore. These grabs are wearing out and experience with them has shown that it should be better to revert to their prewar bucket type of dredger.

II. WHARVES & EQUIPMENT

4. The most important works coming under this head, namely, Transit Sheds at Ahlone Wharf, Brooking Street Wharf No. 2 and Sule Pagoda Wharf No. 4, are already being dealt with under the ECA Aid Programme and these valuable facilities should come into traffic use by the end of 1952. What remains to be attended to on a systematic basis is the restoration of rail, trolley and crane tracks, improvement of road facilities, construction of ancillary buildings, such as stock godowns, open sheds in the Wharf Yards, labour centres, etc., replacement and augmentation

of mechanical handling equipment, wharf cranes, etc., and the complete rehabilitation of the electrical cable distribution system at the wharves.

III. GODOWNS & OTHER BUILDINGS.

5. Apart from the Transit Sheds and warehouses at the wharves, there exists a very considerable number of storage godowns at the Lanmadaw and Botataung foreshores and in other areas serving the needs of the inland trade. These are mainly Nissen huts, in various stages of disintegration, and a steady programme of replacement by permanent structures will need to be undertaken. A similar program is required for providing quarters for workers, especially those who must reside near the river. Previously, when the labour force was largely foreign, and lived as single men, they could be accommodated four or five to a room. Now, with Burmanisation, two such rooms are required to accommodate each single worker and his family.

IV. JETTIES

6. Nearly all pontoons immediately required are already being provided through ECA Aid. But as inland trade gradually increases more jetty facilities will need to be put down at a rate that will keep pace with the demand.

V. STEAMER MOORINGS

7. 16 sets of additional moorings (8 double sets) will be needed to accommodate shipping in the prewar numbers. 2 double sets are already being provided by the ECA and 6 more double sets are here allowed for at the rate of 1 double set a year commencing from the second year.

VI. MISCELLANEOUS

8. The largest item under this head is a new dry dock. There is in Rangoon a small privately-owned dry dock. It is ill-equipped, it is of insufficient size to accommodate many of the larger vessels belonging to the Commissioners and the Burma Navy, and even now the calls made on this dry dock by the Burma Navy, the Government Marine Department and the Commissioners for their smaller craft are more than what the dry dock can accept. The Naval Fleet is growing in size and the Commissioners are also planning to enlarge their flotilla. Further, there is every likelihood that more and more Burmese shipping companies will enter the coasting trade with small and medium sized seagoing craft. For the past few years therefore, the question of having a larger and properly equipped dry dock has been engaging the attention of the three departments mentioned. Dry dock facilities are usually provided by the port authorities and it will be the Commissioners who will be expected finally to operate the dock. It is estimated that to meet Burma's needs in the near future, a dry dock would need to be about 400 feet in length and 60 feet in breadth with a draft of about 15-20 feet. Before any work can start, suitable sites will have to be looked for, the ground tested by borings and experimental sinkings of piles, etc., and detailed plans drawn up. Such a project is not within the capacity of local technical resources and is essentially one to be dealt with by experienced Consulting Engineers.

LATER DEVELOPMENT PROJECTS

9. (*a*) *For seaborne trade*: It will be noted that the seven-year programme now envisaged does not provide for any addition to the number of wharf berths for seagoing vessels, and throughout the period there will be in use one rice-loading berth at Ahlone and six general cargo berths at Sule Pagoda Wharves Nos. 1 to 4 and Brooking Street Wharves Nos. 1 and 2. (There were 10 general cargo berths just before the war.) It is expected that the present six cargo berths will just suffice to keep up with the growth of traffic up to near prewar levels once the new transit sheds are built and the output efficiency of each berth further increased by the provision of properly planned and laid out rail, trolley and crane tracks, good yard facilities, better and more mechanical handling equipment and a full complement of wharf-head electric cranes.

Once the traffic approaches prewar figures however new wharf berths will become imperative. Possible sites are

(i) Nos. 5, 6 & 7 Sule Pagoda Wharves;

(ii) Future No. 2 Ahlone Wharf (a reserved site immediately to the south of the present Ahlone Wharf).

No. 5, Sule Pagoda Wharf was damaged badly during the war. But the ground is known to be good and this berth will probably be the first to be reconstructed. Nos. 6 and 7 Sule Pagoda Wharf stand on unstable subsoil. Detailed investigations of the suitability of the site for modern wharves will need to be undertaken, and special methods of ensuring good foundations examined by consulting engineers. Provision has been made for such preliminary work within the estimates of the seven-year programme. The future site of No. 2 Ahlone Wharf has good water and is believed to be over good ground. But here again preliminary investigations could suitably be undertaken within the seven year period.

(*b*) *For Inland Trade*: Inland trade is catered for at present mainly at Lanmadaw and Botataung. These areas are becoming congested and will become even more so in later years. A major scheme which will need to be carefully investigated is the complete re-design and realignment of the Lanmadaw foreshore for more efficient traffic operation, with reclamation on the river side to give more land and storage area. New foreshore areas suitable for development as inland depots for general or particular trades may also have to be sought in those later years.

THE PORT OF RANGOON

ESTIMATED PROGRAMME OF CAPITAL WORKS AND EXPENDITURE—1952-1958 (7 YRS.)

Nature of Works	1952 *Rs. lakhs*	1953 *Rs. lakhs*	1954 *Rs. lakhs*	1955 *Rs. lakhs*	1956 *Rs. lakhs*	1957 *Rs. lakhs*	1958 *Rs. lakhs*	*Total Rs. lakhs*
I. FLOTILLA								
(a) 2 Buoy Vessels	50.00	—	—	50.00	—	—	—	100.00
(b) 1 Survey Vessel	35.00	—	—	—	—	—	—	35.00
(c) 1 Fire Float	—	20.00	—	—	—	—	—	20.00
(d) 2 Light Vessels	—	7.00	7.00	—	—	—	—	14.00
(e) 6 Heave-up Boats	3.00	—	3.00	—	3.00	—	—	9.00
(f) 8 Harbor Launches	3.00	3.00	3.00	3.00	—	—	—	12.00
(g) 7 Works Barges	—	4.00	4.00	2.00	2.00	2.00	—	14.00
(h) 2 Tugs	—	5.00	5.00	—	—	—	—	10.00
(i) 1 Bucket Dredger	—	20.00	—	—	—	—	—	20.00
II. WHARVES & EQUIPMENT								
(a) Roads & Rail Tracks	—	1.50	1.00	—	—	—	—	2.50
(b) Ancillary Buildings	—	3.00	3.00	3.00	—	—	—	9.00
(c) Mechanical Handling Equipment	—	3.00	5.00	4.00	—	—	—	12.00
(d) Electric Cable Distributing System	—	—	—	3.00	3.00	3.00	—	9.00
(e) Wharf Cranes	—	—	—	—	3.00	3.00	3.00	9.00
(f) Reconstruction of Nos. 5, 6 & 7 Sule Pagoda Wharf—Site Investigation	—	—	1.00	1.00	—	—	—	2.00
III. GODOWNS & OTHER BUILDINGS								
(a) Godowns	4.00	4.00	4.00	4.00	4.00	4.00	4.00	28.00
(b) Stores & Workshops Bldgs.	—	—	1.00	1.00	1.00	1.00	1.00	5.00
(c) Workers' Quarters	3.00	3.00	3.00	3.00	3.00	3.00	3.00	21.00
IV.								
Pontoon & Fixed Jetties	3.00	3.00	5.00	5.00	5.00	5.00	5.00	31.00
V.								
Steamer Moorings	—	8.00	8.00	8.00	8.00	8.00	8.00	48.00
VI. MISCELLANEOUS								
(a) Foreshore & Development Projects	—	1.00	1.00	1.00	1.00	1.00	1.00	6.00
(b) Engineering & Workshops Plant	2.00	2.00	—	—	—	—	—	4.00
(c) New Dry Dock	—	—	2.00	2.00	10.00	20.00	20.00	54.00
VII.								
Reserve for Unforeseen Expenditure	5.00	5.00	5.00	5.00	5.00	5.00	5.00	35.00
GRAND TOTAL	108.00	92.50	61.00	95.00	48.00	35.00	50.00	509.50

Section VIII b

RAILWAY TRANSPORTATION

A. ORGANIZATION OF THE BURMA RAILWAYS.

1. The operation of railways in Burma is in effect a complete monopoly of the Government of the Union of Burma (GUB). Although there are four privately owned railways, each is light in construction, extremely short in length, and of no significance to the overall transportation picture in Burma, apart from the 50 mile, 2′ gauge line from Namyao to Bawdwin of the Burma Corporation (1951) Limited, which normally feeds heavy tonnages into the Burma Railways. There are no physical connections or interchange of traffic between the Burma Railways and foreign railways. The Burma Railway is therefore substantially a self-contained. single system.

2. The Burma Railways are controlled and operated in accordance with the provisions of the Union of Burma Railway Board Act, 1951, under which the President has constituted the "Union of Burma Railway Board" (Board), a corporate body having a full time Chairman who is also the Chief Executive Officer of the Railways. The Board consists of ten other members, including the General Manager of the Burma Railways, a representative of the Ministry of Finance & Revenue, the Secretary of the Ministry of Transport & Communications; four non-official members nominated by the Government and three members representing the Burma Railways Workers Union. Subject to the control of the President, the Board is empowered to "regulate, construct, maintain and operate railways in the Union of Burma"; "undertake other activities necessary or expedient for the proper carrying out of its functions under this Act"; and "shall act on business principles, with due regard to the interests of agriculture, industry, commerce, and the general public". The Board may borrow money and issue loans with the prior sanction of the President. All moneys received by the Board are credited to the "Railway Board Fund" and these funds are handled for the conduct of business under the By-Laws of the Board. The accounts of the Board are audited annually by the Auditor-General of the GUB, which audit is submitted to the President and Parliament.

3. Under the policies of the Board and the Chairman thereof as Chief Executive Officer, the Burma Railways are directed by the General Manager who has seven Staff Chiefs reporting directly to him: the Deputy General Manager, Chief Engineer, Traffic Manager, Chief Mechanical Engineer, Chief Medical Officer, Controller of Railway Accounts, and the Controller of Stores. The chart at the end of this Section shows further details of organization, including the more important field elements and installations. This organization is well calculated to provide centralized control with decentralized operations.

B. BACKGROUND OF BURMA RAILWAYS

1. The Burma Railways have gone through a considerable succession of organizational changes since the first line was opened in 1879 from Rangoon to Prome as the "Irrawaddy State Railways". Prior to World War I (WW I) the line had been extended from Rangoon through Mandalay to Lashio, Alon, and Myitkyina, and branch lines built from Henzada to Bassein, from Pegu to Martaban, and into the Southern Shan States as far as Kalaw. The large rice profits of WW I were invested in extending additional branches, Moulmein to Ye, Pyinmana to Taungdwingyi, and Alon to Ye-U. A few additional minor branches were constructed in the 1920's, and after 1930 certain significant additions were built, particularly the Taungdwingyi—Kyaukpadaung and the Myingyan—Paleik lines intended primarily as parts of an eventual alternative route from Rangoon to Mandalay via Allanmyo and Prome. Other proposed branches were surveyed, but for various reasons were not built.

2. The initial railway development was sponsored by the Government, and remained as a Government opera-

tion until it was taken over in 1896 by the Burma Railways Company, Limited, London, under a lease extending to 31st December, 1928. At this date it was again taken over as a Government operation under the control and management of the Indian Railway Board, New Delhi. As early as 1920 an Advisory Council was set up in Burma under which local interests had advisory authority, but that only. In 1937, on the separation of Burma from India, the railway was transferred to the Burma Government, and the Advisory Council became the Burma Railway Board. The Board was controlled by the Government with respect to policy, but in the actual administration and operation of the railway it acted on its own responsibility. The Board is reported to have been extremely efficient, and to have attained a high degree of excellence in railway service. World War II (WW II) brought destruction and change, with the Railway Administration evacuated to Simla where detailed plans were made for the restoration of the Railways upon the termination of WW II. The Burma Railways (Emergency Provisions) Act of 1943 made certain adjustments in management, and continued in force until the Union of Burma Railway Board Act, 1951.

3. Prior to WW II Burma had one of the best meter gauge railway systems in operation in southeast Asia, comparing most favorably with those of Thailand, Indo-China, Malay and Indonesia. It was, of course. a natural target at the very onset of war; denial action and enemy bombing took an immediate toll. During Japanese occupation, allied bombing was almost constantly directed at disrupting rail transport: bridges, workshops, marshalling yards, running-sheds, rolling-stock, engines and ferries were heavily damaged or destroyed. The Japanese removed rails, sleepers and fittings from all double-track line, and from several of the branch lines having no military importance to the Japanese. Reconstruction, planned at Simla, was undertaken immediately after WW II, with military and civil equipment and supplies, and by Independence most of the line had been reopened to traffic, except for vital bridge gaps, such as the Ava, Sittang, Gokteik and Daga, and for certain branch lines dismantled by the Japanese. Insurgency again made the railways a primary target; bridges, stations and even parts of tracks and trains were damaged or destroyed. Railway operations steadily diminished until a low point was reached where only twenty-one miles of railway line were in operation at the height of insurrection. With constantly increasing control over insurgency, operating conditions are being restored to a somewhat more effective status but are far from normal in any sense. Damages and progress in rehabilitation are shown in part in the following summaries. By the 30th September, 1951, repairs had been completed on 300 bridges, with temporary repairs completed on many others. Of the three largest and most vital bridges, the Sittang was destroyed and is being redesigned for construction at a new site; the Ava lost two 350-foot spans and preliminary work in restoration has begun; and the Gokteik was severely damaged, with restoration now complete.

BRIDGES

	Pre-WW II	*Damaged in WW II and by insurgents prior to 30 Sept. 1950*	*Damaged by Insurgents 1 Oct. 1950-30 Sept. '51*
Spans of 125′ or over	55	28	
Spans 100′ to 120′	116	90	Breakdown
Spans of 60′	154	54	not available;
Spans less than 60′	4,058	349	total only
Total	4,383	521	141

RAILWAY LINE AND ROLLING STOCK

	Prewar	*Postwar* 1945	*Status* 30.9.50
Route Miles	2,059	674	1,771
Locomotives	369	60	313
Carriages	1,167	204	373*
Wagons	9,663	2,751	6,871**

*Includes American Bogie covered wagons converted into passenger carriages.
**Includes about 1,000 American covered goods wagons imported by British Army.

4. The primary present requirement is rehabilitation. Although a few specific improvements are indicated, they are not significant to the problem as a whole. The Board has accepted in general principle the target of the Simla plan to restore only 1,867 route miles instead of the original 2,059 miles, omitting normally unremunerative branch lines as follows:

	Miles
Pegu-Thongwa line	49
Part of Moulmein-Ye line	31
Alon-Ye-U line	50
Part of Myingyan-Paleik chord line	62
Total	192

This plan is being followed. Complete rehabilitation must await the return of law and order. In the meantime, great effort is being made in rehabilitation and results are consistent with this effort.

5. The immediate step in the work of rehabilitation is to open as many miles of communication as possible regardless of defective conditions. Gaps in the line are inevitable during periods of rehabilitation because the repair or rebuilding of big bridges requires planning, design, material and construction—all of which takes time.

C. EXISTING RAILWAY LINES.

1. There were 2,059 route miles of line pre-WW II. The general status of these lines as they exist today is shown on the map enclosed at the end of this Section.

Lines under traffic, held or damaged by insurgents, and dismantled by Japanese and not yet replaced are shown separately. This shows 1,554 miles of line cleared of insurgents, of which 89 miles are not yet operable. There is no double-track at this time, priority being given properly to reestablishment of single track operation.

2. TRACK. The lack of maintenance from which the track has suffered throughout WW II and thereafter has been such to render impossible the fast running of trains. A program of annual relaying of 40 miles of track was adhered to pre-WW II so that in 50 years' time, which is the estimated life of the rails, the whole system would be relaid. This work has fallen into arrears. Allowing for less traffic during these years, it is considered that the accumulated deficit is at least 200 miles, which, with current requirements, means some 240 miles of rails and fastenings now need renewal.

3. SLEEPERS. Cross-ties or sleepers are of teak, Pyingado and Thitya-Engyin timber, 6′ x 8″ x 4½″ for line, and 6′ to 12′ x 10″ x 6″ for turnouts. Teak is most excellent for such use and has an average life of 25 years. Other hardwood sleepers pre-WW II had an average life of 13 years. The average annual replacement requirement is 450,000 units for line and 2,000 tons of special sized sleepers. Largely because of insurgency, hardwood sleepers can no longer be obtained in the required quantities. Softer woods are usable, but require creosoting to give them a reasonable useful life. A cresote plant has been procured and was scheduled for installation at Mandalay; however, the insurgents destroyed the building and although the equipment was saved, it remains unused to date. Deferred maintenance has created a backlog reported as 35 lakhs of line sleepers and 15,000 tons of special size sleepers.

4. BALLAST. Line maintenance pre-WW II required 40 lakhs cu. ft. of ballast renewal per year. Main line ballast is of crushed granite; branch lines of river shingle or crushed limestone. Deferred maintenance requires 350 lakhs cu. ft. of ballast for renewal.

5. GAPS. The map at the end of this Section shows also the most important river crossings at which there are gaps in the line:

a. The Martaban-Moulmein water crossing is 3.0 miles, and was never connected by a bridge. Pre-WW II the Irrawaddy Flotilla Co. operated a ferry between these two points.

The passengers and merchandise were transhipped by this ferry and all the merchandise had to be unloaded from the wagons or freight cars on the Martaban side and transferred by barges across to Moulmein and vice versa. However, once a year the Railways arranged a special crossing which was operated by chartered power vessels using special railway pontoons for the transfer of Railway rolling stock between Martaban and Moulmein South. This crossing was specially arranged in order that those vehicles and locomotives on the Moulmein side which are in need of heavy repairs, which could not be carried out locally, were thus transferred back to the Martaban side and an equal number sent across to Moulmein as replacements. This is a special yearly crossing, and is not a part of the normal train services. The rail operation from Moulmein south is therefore in effect an operation separate from the rest of the line.

b. The Sittang River bridge was destroyed in WW II, leaving a gap of 0.3 miles. The tidal bore of the Sittang River had made this bridge unsafe pre-WW II; its relocation upstream by nine miles was then planned. Realignment of the rail line to the new site, estimated to cost a total of Rs. 90 lakhs, was well underway after WW II when work was halted by the insurgents. The new bridge which will be combined rail and highway is now being designed in London by consultants to the Board and will cost approximately Rs. 2.1 crore. The importance of this bridge is emphasized because it serves as a link between Rangoon and the quarries at Mokpalin and Taungzun. The construction of roads, especially in Lower Burma, is mainly dependent upon the stone-metal obtained from these quarries across the Sittang River. It is vital to have this bridge built as promptly as possible. The Board operates a ferry across the Sittang River, capable of accepting loaded goods wagons, which connects the rail operation from Martaban with the main line.

c. The Daga River bridge remains destroyed, and the line itself in this vicinity is in the hands of insurgents. The Henzada-Bassein has been a profitable branch through the years, carrying heavy tonnages of rice to Bassein. This branch line is important to agriculture in a large part of the delta.

d. The Irrawaddy was never bridged between Henzada and Tharawaddy Shore. The Railways maintain a ferry service here which provides substantially as good service as pre-WW II.

e. The most significant gap is the damaged Ava Bridge crossing of the Irrawaddy River from Amarapura to Sagaing, a distance of 3.25 miles. An organization competent to erect the two new trusses is at the site, doing the work of clearing the two demolished trusses from the river channel, and other preparatory work. Steel for the new trusses is expected from the U.K. in June, 1952. Because this connects the Mandalay-Rangoon line with the extension from Sagaing through Shwebo and Mogaung to Myitkyina, a distance of nearly 400 miles, its importance is great. Moreover, it is also a highway bridge, normally producing revenue from tolls. The completion of the Ava Bridge should be expedited by all reasonable means. In the meantime, the Railways operate their own ferry for loaded goods wagons, and a ferry for road vehicles is privately operated.

f. River crossings of lesser importance are those at

Mogaung, Nyaungbinwun, and Tahapalai. Mogaung has been repaired to permit through-running of trains, but requires early replacement. Nyaungbinwun is on a line in the hands of insurgents. Tahapalai is now undergoing permanent repair, and has progressed sufficiently to permit through-running.

It is patently inefficient and costly, and a deterrent to business, to carry on operations with bridges of such vital importance still not completed and in use. Moreover, the insurgents continue to harass current operations by destruction of bridges and line. These sustained actions increase the seriousness of the operational difficulties. The rehabilitation of bridges, therefore, presents serious difficulties, the solution of which is imperative.

6. BUILDINGS. The Burma Railways undertake to provide housing for the bulk of its approximately 22,000 employees. The District Engineers are responsible for the construction of office buildings, stations, quarters, institutes and other facilities. During WW II, nearly all the Railway buildings were destroyed or damaged by bombing, fire, or the depredations of looters and billeted troops. The greatest destruction was at the 44 principal stations, which were practically obliterated. Staff Quarters, Officers' Bungalows, Service Buildings, Dispensaries, Platforms, Engine Sheds, were also destroyed. Provision of staff quarters and service buildings was therefore one of the most urgent necessities during the early years of reconstruction; shortage of buildings materials has prevented rapid progress. However, permanent rehabilitation of a large percentage of buildings at major stations like Insein, Rangoon, Pegu, Toungoo, Myitnge and Mandalay, has now been completed, but much remains to be done. Of a total of approximately 13,000 units to be constructed, about 8,500 units have now been completed. If adequate housing accommodation is to be provided for staff such as gangmen, who are at present required to share quarters at the rate of 2 men per unit, more quarters in the neighborhood of 2,500 units will be required, at an additional expenditure of Rs. 50 lakhs.

7. SIGNALS. The signals system was destroyed in its entirety during WW II. The Simla plan for the rehabilitation of the signals system has been followed. Major portions have been installed, as follows

a. Power Signalling in the Rangoon Yard has been completed, while estimates for the Malagon Marshalling Yard are being prepared.

b. Automatic Signalling between Rangoon and Kemmendine has been installed and is in use.

c. Electro-Mechanical Signalling materials for 38 stations between Toungoo and Myohaung have been received. Installation has been impeded by insurrection. Arrangements have also been made for the installation of a modified type of electro-mechanical signalling at the stations between Rangoon and Toungoo.

d. Mechanical Signalling installations have been completed at stations between Insein and Prome and materials for stations between Pegu and Martaban are available for installation.

e. "Branch line signalling" is a simple type adopted for all branch lines except Ywama-Prome and Pegu-Martaban. Installation is completed in the Thazi-Myingyan and Thazi-Shwenyaung Sections.

f. The telegraph system is dependent upon the landlines installed and maintained by the Telecommunications Department of the Ministry of Transportation and Communication. The Railways connect to these lines, and provide their own telegraph instruments for use. This mutually supporting arrangement has worked satisfactorily through the years. However, it is impossible for the Telecommunications Department to maintain landlines except in very limited mileages. Train operations are greatly hampered by the lack of signals. Correction can come only with law and order. In the meantime, a partial solution has been found by the railway in the installation and operation of a radio net connecting Rangoon, Toungoo, Thazi, Mandalay and Katha, which provides excellent communication for general railway administration and business substituting for the normal "through-wire" communication.

D. RAILWAY CONSTRUCTION STANDARDS.

The construction standards adopted for the Railway have not been attained throughout the line, and in some cases deviations from standards have been imposed by special circumstances. The entire railway system is meter gauge, 3' - 3⅜". The maximum degree of curvature allowable in the main line is 4° for unrestricted speed; and 17° for the Ghat section. Maximum grade is 0.5% on main line, 1% on branch line, and 4% in Ghat sections. Rail is 75# per yard on main line, 60# on important branch lines, 50# on less important branch lines and sidings. Granite or lime-rock ballast is 7' 6" in width at foot of rail, 8" depth below sleepers, and is 1½" maximum to ½" minimum size. Sleepers are hard or durable indigenous woods, 6' x 8" x 4½", and 6' to 12' x 10" x 6" for turnouts. Bridges are designed for 13 tons axle load for the main line, 10 tons on branch lines. Certain special bridges have been designed for higher loads, such as the Ava with 17 tons axle load. Maximum permissable train speed is 45 m.p.h.

E. TRACTIVE POWER.

1. The locomotive position is generally satisfactory for the present and near-term. Types and numbers on hand are given below. Of this total number, 20 YD (Heavy), 50 YB (Medium) and 28ST (Tank) are new, having been received from the United Kingdom since WW II. The remainder are old engines belonging to the Railways pre-WW II, and surplus war stock received from the British Army.

	Actuals 31.3.39	*Actuals* 15.7.50	*Contemplated by* 1.10.1952
*Garratt	35	27	23
Heavy	74	101	103
Medium	141	106	104
Tank	75	57	57
Light	44	26	21
Total	369	317	308

* This figure includes locomotives of the Mallet Type.

2. Immediately after the war, proposals were made to convert some of the locomotives for oil-firing, mainly on account of the high cost and uncertain supply of coal imported from India. These proposals were dropped as it was thought that the intended economy could not be achieved, the price of oil having risen also. It would seem desirable to proceed with the conversion of a limited number of locomotives from coal to oil firing, establishing and maintaining accurate, comparative, operation cost data including all elements of cost involved. Burma now produces oil and will probably in due course produce coal. Burma should take the long-range view of using indigenous, not imported products. Such comparative data are essential and basic for future industrial planning as well as for the determination of the most economical methods of railway operation.

3. Much trouble has occurred in the past in the watering and bunkering of steam engines, causing undesirable interruptions in work with resultant delays to loads in handling the inward traffic in the Rangoon suburban area, around goods depot and along the docks. It was proposed therefore that diesel mechanical shunting engines be procured for use in these areas. This proposal was considered more costly than steam, and therefore was dropped. However, diesel shunters have many definite advantages over steam shunters. The procurement, use and specific comparative test in operational use of a limited number of diesel shunters would seem desirable and is recommended.

F. ROLLING STOCK.

1. CARRIAGES. Pre-WW II the railways operated a total of 1,167 carriages of all types. WW II brought about the destruction of all but a relatively few of this number. Post-WW II rehabilitation reached 358, including a large number of the American Bogie Covered Wagons converted for passenger use. As a result of insurrection many carriages have again been damaged or destroyed and no proper account of some carriages left in insurgent areas has yet been possible. Most of the order placed in India for 250 underframes and 200 all-steel bodies has been received; the intention was to have these erected in the Carriage and Wagon workshops at Myitnge near Mandalay. Because this line had been cut by insurrection it has not been possible to send these to Myitnge, and the building of these body-shells is being carried out in Rangoon and now nearing completion. Simultaneously with the Indian order, there was also an indent for underframes and bodies for 200 carriages placed in U.K. but subsequently it was found necessary to alter the order to completely fitted carriages ready for use on arrival. It has now been decided to limit the order to 100 complete carriages, part of which have been received. This number of carriages is urgently needed, with a like number needed within another two years.

2. The local passenger trains running between Rangoon and Insein, Mingaladon Cantonment and Thingangyun present a special problem. Before the advent of road competition these local trains were almost the only means of travel for people living outside Rangoon for a distance of 10 miles. Today these trains are fairly well used, even though they are slow and the frequency of the service is poor, the average interval between trains being more than one hour. A partial reason for this is the shortage of carriages which has compelled the use of the roughly converted American Bogie Covered Goods Wagons as carriages. Adequate carriages should be provided at the earliest practicable opportunity. An excellent, though rather expensive solution would be the introduction of diesel oil-engined rail cars on these runs. The three-car unit type of trains would appear to be suitable. Operating costs of these trains should be less than present operations; and the problem of ticket-less travel should find rapid local solution with this equipment in use. It would appear that the procurement, use and comparative test of a limited number of such trains is desirable.

3. WAGONS. The position with respect to wagons is only fair. Even this position has been attained by reason of the one thousand American Bogie Wagons received at the end of the war, and to the timely construction in 1948 of some 1,800 wagons at Myitnge from materials received under order from U.K. and India before the outbreak of insurrection. The American Bogie Wagons were built for war purposes; the side-sheeting and roofs are of plywood. These are being replaced with zinc and will require to be replaced as time goes on to keep them further in use. Another drawback with these wagons is the fact that the wheels are of chilled cast-iron and their profiles are already badly worn. Some 8,780 wheels are involved and since they have to be replaced, 500 Rolled Steel Wheels have been ordered and replaced while a contract for another 1,000 wheels has already been placed. A regrinding of those less badly worn wheels may be worthwhile to give them further useful life. There is immediate need for increasing the number of usable wagons. A considerable number are awaiting rehabilitation at the workshop at Myitnge. There are others in actual use which should be rehabilitated. Still others are in insurgent held areas. Restoration of these wagons to maximum use, accompanied by the faster running of trains, would assist in providing adequacy in numbers of wagons for the near-term.

4. There are certain special comments regarding rolling-stock. First and second class carriages are now combined into an "upper class" carriage, providing amenities above those of the widely used third-class carriage. Improvements in the latter provide drinking water and wash water, not provided pre-WW II. Wagons, deficient in number, are likewise deficient in type; for example, it appears that refrigerated wagons for the shipment of perishable vegetables are needed. The availability of the type of goods wagon to suit offered goods is important in reducing breakage and pilferage.

G. SHOPS FOR MAINTENANCE OF ROLLING STOCK, WAYS AND STRUCTURES.

1. The locomotive workshop at Insein was largely destroyed in WW II and has been rebuilt. It is well planned and equipped for efficient operations. Most of the equipment for complete "back-shop" work has been received and installed. It has a capacity of approximately 12 heavy repair jobs per month. In addition, there are five locomotive sheds properly spaced along the railway line which are capable of intermediate repairs, and an additional 13 locomotive sheds at about 100 mile intervals equipped for and capable of performing running repairs.

2. The Carriage and Wagon Workshop at Myitnge was greatly damaged during WW II, suffered additional damages at the hands of the insurgents, and accordingly is in only fair condition at this time. The wood-working mill is destroyed. The power plant is partly restored with new boilers, but power is seriously deficient in spite of the use of three stationary wood-fired locomotives as auxiliaries. Restoration of the plant as a whole is proceeding slowly. Handwork and manual labor are substituted where machines are lacking, or where power is lacking for the operation of machines. This workshop is capable of performing all types and degrees of repairs to carriages and wagons, including wood or metal work, or the assembly of a complete unit. Power, power-tools, and some machine tools are seriously needed. Employment is approximately 2,000 men.

3. The Civil Engineering Workshop located in Rangoon was heavily damaged in WW II but has been largely repaired and equipment restored or replaced. Work required by the Civil Engineering Department is accomplished here, including the fabrication of points, building or repair of girders and trusses, and any job requiring normal machine-shop work. The repair of signal equipment is accomplished in a separate section. Shortage of metal stock and various spare parts reduces capacity.

H. TRAFFIC.

1. STATISTICS. The Railway Board has its own Statistics Section which assembles and compiles in usable form statistics and pertinent facts concerning many facets of operations. Destruction in WW II has left almost no prewar data. There are no records pertaining to the war years. Data since WW II are available, but are of relatively little usefulness in traffic studies by reason of the extreme abnormality of operations in a period of postwar rehabilitation and insurrection. Had records not been lost, there would exist data adequate to establish trends in changing sources, types and volume of business, and in general provide data prerequisite to adequate planning. Under existing conditions it appears best to place greatest reliance on data pertaining to the several years preceding WW II in an evaluation of probable future railway traffic in the post-insurrection period.

2. GOODS TRAFFIC. The following Tables I and II show the general distribution of goods traffic and goods earnings, with percentages of totals for each commodity, for the fiscal years 1938-39 and 1939-40, and 1948-49 and 1949 50, respectively:

TABLE I

GENERAL DISTRIBUTION OF GOODS CARRIED, and EARNINGS THEREFROM, 1938-39 and 1939-40

(*Figures in thousands*)

Commodities	1938-39						1939-40					
	Tons		*Ton miles*		*Earnings*		*Ton*		*Ton miles*		*Earnings*	
	No.	*Percentage of total*	*No.*	*Percentage of total*	*Rs.*	*Percentage of total*	*No.*	*Percentage of total*	*No.*	*Percentage of total*	*Rs.*	*Percentage of total*
1. Indigenous Agricultural Produce	1,865	46.0	292,592	42.0	12,671	48.1	1,737	43.4	276,385	40.3	12,065	43.6
2. Indigenous Mineral Products	472	11.6	92,645	13.3	3,096	11.7	369	9.2	73,375	10.7	3,050	11.0
3. Indigenous Forest Produce	257	6.3	41,689	6.0	1,166	4.4	282	7.1	41,879	6.1	1,179	4.3
4. Indigenous Live Stock	10	0.3	2,359	0.3	336	1.3	12	0.3	3,080	0.5	416	1.5
5. Miscellaneous Commodities (chiefly manufactured articles)	502	12.4	127,255	18.2	7,052	26.7	582	14.5	147,774	21.5	8,902	32.1
6. Imported fuel	74	1.8	37,909	5.4	948	3.6	71	1.8	36,535	5.3	909	3.3
7. Military Stores	11	0.3			36	0.1	9	0.2			46	0.2
8. Railway Materials	866	21.3	103,091	14.8	1,083	4.1	939	23.5	106,840	15.6	1,095	4.0
9. Demurrage, Wharfage, etc., less Refunds	....	....	....	....	1	....	....	....	....	....	-3	....
TOTAL	4,057	100.0	697,540	100.0	26,389	100.0	4,001	100.0	685,868	100.0	27,659	100.0

TABLE II

GENERAL DISTRIBUTION OF GOODS CARRIED AND EARNINGS THEREFROM, 1948-49 AND 1949-50

(Figures in thousands)

Principal Divisions of Commodities	1948-1949 *Tons*	*% of Total Tonnage*	*Ton Miles*	*Rs.*	1949-1950 *Tons*	*% of Total Tonnage*	*Ton Miles*	*Rs.*
Agriculture	346	44.2	45,867	5,540	380	45.6	29,376	6,563
Mines	57	7.2	11,003	1,262	55	6.4	2,644	640
Sea	25	3.2	4,884	500	15	1.7	1,140	205
Forest	63	8.1	8,228	539	82	9.7	5,908	676
Animal Farming	8	1.0	1,666	294	2	0.2	191	89
Military Accoutrements & Stores	5	0.7	753	209	7	0.8	628	226
Others	64	8.3	9,590	1,459	56	6.6	2,706	1,954
Dep'tmental	216	27.3	17,831	588	236	29.0	13,401	713
Total	784	100.0	99,822	10,391	833	100.0	55,994	11,066

Although there are some differences in the breakdown of commodities between the two tables, essential comparisons are permitted. Agricultural products constitute nearly half of the goods traffic, with no significant change from pre-WW II to current conditions. Reduction by about 50% in minerals, and increases of 25-30% in timber and railway-owned goods are believed to be only manifestations of post-WW II unsettled conditions. Otherwise the commodity pattern is currently about the same as pre-WW II, as would be expected.

3. The quantity of goods moved has dropped from an average of slightly over 4 million long-tons per year in the period 1936-40 to a high after WW II of 2.1 million in 1947-48, and an approximate low of 0.8 million per year in 1948-49 and 1949-50. The average number of miles a ton of goods was hauled also shows an expected decrease from about 170 to about 105; it is considered that the post-WW II period is too unsettled to draw any inference from this comparison. With the opening of the Goktiek viaduct, the main line from Mandalay to Rangoon, and an increase in total mileage open, there should be some definite improvement in 1950-51.

4. From all data available respecting past records of goods carried by the railways, an effort has been undertaken to make a forward projection of expected future tonnage. It is recognized that available data are scarce, and that all data since 1942 require careful interpretation in use. Nevertheless, it is estimated that the expanding economy of Burma will bring a 30% inerease by the year 1959 in the total national production of Burma as a whole as compared with 1938-39, and a 60-75% increase in 1969. These estimates also show essentially the same percentage increase in freight traffic by railway. They are summarized as follows:

TABLE III

PROJECTION OF RAILWAY GOODS TRAFFIC

	1938-39	*Target Year* 1959	*Target Year Plus 10 years* 1969
Total Production in Burma Percentage of 1938-39	100	130	160-175
Goods Traffic, Burma Railways Thousands of tons	4,057	5,050	6,700-7,800
As percentage of 1938-39.....	100	125	165-192

5. PASSENGER TRAFFIC. Table IV below shows that passenger traffic, which averaged above 30 million in the late 1920's, steadily declined at an approximate uniform rate to about 20 million persons in 1936-7. From that date to the beginning of WW II there continued a less regular or rapid diminution in passenger travel, but data are sufficient to make a trend of slow decrease. The number of miles a passenger was carried in 1936-41 averaged about 24 miles, with little variation in annual averages. Post-WW II data vary so greatly with changing conditions as to warrant no inferred trend. The maximum number of passengers carried in any post-WW II year is 9 8 million passengers in 1947-48 and the lowest number is 4.4 million in 1948-49. The average miles a passenger was carried in the post-WW II period varies from a high of 29.6 miles in 1947-48 to a low of 16.1 miles in 1949-50; the period is too unsettled, however, to permit the drawing of any inference as to positive trends. There is an inescapable trend, however, through the years since 1929 in the diminution of the numbers of passengers carried, and is doubtless being taken into full account by the Railway Board.

TABLE IV

NUMBER OF PASSENGERS CARRIED

(By Class)

Year	I Class	# II Class	III Class	Total	Average No. of Miles a Passenger Was Carried
1929-30	58,365	612,114	32,543,338	33,123,817	*
1930-31	51,643	539,998	28,270,649	28,862,290	*
1931-32	38,379	378,569	22,430,568	22,847,516	*
1932-33	31,865	298,249	20,878,877	21,208,991	*
1933-34	26,908	242,075	20,060,753	20,329,736	*
1934-35	24,578	254,921	20,456,582	20,736,081	*
1935-36	23,077	265,164	20,270,975	20,559,216	*
1936-37	19,783	261,284	19,991,711	20,272,778	23.9
1937-38	18,663	228,731	19,155,785	19,403,179	23.9
1938-39	14,793	235,581	18,669,934	18,920,308	23.1
1939-40	13,804	218,994	18,577,553	18,810,351	23.9
1940-41	14,942	219,677	19,523,460	19,758,079	25.2
1941-46	*	*	*	*	
1946-47		15,762#	7,699,656	7,715,418	*
1947-48		30,722	9,814,824	9,845,546	29.6
1948-49		5,999	4,412,991	4,418,990	16.8
1949-50		*	*	6,600,000	16.1

* Data not available.
#First and Second Class service combined into "Upper Class" after WW II.

6. There are now two substantially new factors which will affect railway passenger traffic in the future, namely, the transportation facilities offered by the highways and airways. Over the long-term it is inescapable that an ever-increasing volume of passenger car and bus travel will take place by highway. The near-term effect may not be material to the railway system as a whole, but will adversely affect certain branch lines. The long-term effect will cut heavily into the railway passenger traffic for both short and long haul. It is regarded as improbable that the near or long-term effect will be offset except in part by other economic factors such as increasing population, travel, and other trends. The airways averaged about 2½ million passenger miles per month in 1949-50; this represents about 6% of the passenger miles by railway pre-WW II, but represents about 20% postwar. The Airways have established real competition in upper class passenger traffic. The increasing competition from airway and highway will definitely have a material, adverse effect upon railway passenger traffic.

I. FISCAL.

1. REVENUE. The following table gives a breakdown of the gross earnings of the railways by fiscal year for the period 1929-40 and 1945-50, divided between coaching, goods and miscellaneous, together with the percentages which coaching and goods revenues represent of the total revenue for each year:

TABLE V

BREAK-DOWN OF GROSS EARNINGS OF THE RAILWAYS 1929-40 and 1945-50

(*In lakhs of Rupees*)

Year	*Coaching*	*% Coaching represents of gross*	*Goods*	*% Goods represents of gross*	*Miscellaneous*	*Gross earnings*
1929-30	158.49	32.2	317.32	64.3	16.58	492.39
1930-31	134.50	31.4	280.00	65.4	14.29	428.79
1931-32	114.27	30.3	251.26	66.0	15.37	380.90
1932-33	106.94	30.3	217.41	61.0	31.39	355.74
1933-34	98.86	26.3	252.18	66.9	25.66	376.70
1934-35	100.92	25.9	265.50	68.1	22.88	389.30
1935-36	104.25	27.9	249.59	66.8	19.55	373.39
1936-37	109.03	28.5	254.35	66.4	19.69	383.07
1937-38	103.87	27.7	253.48	67.6	17.13	374.48
1938-39	96.63	25.8	263.89	70.5	14.30	374.82
1939-40	101.59	25.9	276.59	70.7	13.93	392.11
1945-46	59.00	20.1	217.00	74.1	17.31	293.31
1946-47	139.00	27.6	337.00	67.1	28.28	504.28
1947-48	148.3	31.8	315.2	67.5	3.1	466.6
1948-49	50.6	31.5	103.9	64.6	6.1	160.6
1949-50	79.8	41.0	110.6	57.0	3.7	194.1

2. PROFIT AND LOSS. The following table shows gross and net earnings; gross working expense; including depreciation; interest charges and profit and loss for each fiscal year in the period 1929-41 and 1945-49:

TABLE VI

EARNINGS, PROFIT AND LOSS FOR 1929-41 AND 1945-49

Year	*Gross Earnings*	*Gross Working Expenses including Depreciation*	*Net Earnings*	*Interest Charges*	*Profit or Loss*
	Rs.	*Rs.*	*Rs.*	*Rs.*	*Rs.*
1929-30	4,92,38,872	3,07,88,073	1,84,50,799	1,58,80,199	+ 25,70,600
1930-31	4,28,78,635	3,15,38,168	1,13,40,467	1,58,96,238	— 45,55,771
1931-32	3,80,90,314	2,86,09,781	94,80,533	1,60,96,165	— 66,15,632
1932-33	3,55,73,845	2,75,54,585	80,19,260	1,50,57,780	— 70,38,520
1933-34	3,76,69,989	2,83,11,575	93,58,414	1,54,53,132	— 60,94,718
1934-35	3,89,29,292	2,87,25,527	1,02,03,765	1,50,21,532	— 48,17,767
1935-36	3,73,38,609	2,85,64,984	7,73,625	1,46,72,164	— 58,98,539
1936-37	3,83,06,706	2,66,90,293	1,16,16,413	1,41,90,447	— 25,74,034
1937-38	3,74,47,614	*2,64,68,025	1,09,79,589	1,20,11,827	— 15,54,797
1938-39	3,74,82,398	*2,66,15,694	1,08,66,704	1,22,38,560	— 13,71,856
1939-40	3,92,10,844	*2,68,67,358	1,23,43,486	1,20,89,398	+ 2,54,088
1940-41	4,38,63,199	*2,72,58,829	1,66,04,370	1,20,54,397	+ 45,49,973
	Figures for 1942 to 1944, inclusive, not available				
1945-46	3,01,76,517	*2,72,66,566	29,09,951	1,20,84,508	— 91,74,557
1946-47	5,10,05,643	*4,09,51,705	1,00,53,938	81,69,696	+ 18,84,242
1947-48	4,86,94,549	*5,15,03,536	— 28,08,987	1,41,60,220	— 1,69,69,207
1948-49	1,41,96,716	*4,80,05,524	— 3,38,08,808	1,19,14,702	— 4,57,23,510

* Include the difference between the "Interest on Railway Share of Provident Fund" and the "Interest realized on Provident Fund Investments after provision for redemption" and "Interest on Ways and Means advance from Government", as shown in the Net Revenue Account.

The net losses suffered in the world-wide depression years were being reduced rather steadily through the middle and late 1930's until a net profit is shown for the fiscal years 1939-40 and 1940-41; these are the most favorable reports in a decade and are attributed in substantial part to the increased traffic by rail from Rangoon to Lashio produced by the "Burma Road" traffic into China. The gap in statistical data in World War II is followed by data which show heavy losses, the high value of which is a most compelling illustration of the effect of insurrection,

involving as it does great damage to physical plant with the attending increased capital investment required for rehabilitation and the loss of revenue by interruption of service. It is a certainty that losses will continue to be heavy until security permits the restoration of an approximately normal operation.

3. FUNDING. Subject to the policies of the President and the Board, the Chief Executive and the General Manager administer the daily operations of the railway along business lines. However, prior to the beginning of each fiscal year an estimate of operating revenue and costs is submitted to the GUB which considers these estimates fundamentally as a budget, and, after such adjustment as the GUB sees fit to make, gives sanction to these annual estimates. Actual expenditures of the Railway for each fiscal year may not exceed the total proposed expenditures as sanctioned, without prior authority of the President. Funding of an operating loss for a given year is then made good by appropriation of the required funds by the GUB.

4. RATES. The rate structure of the railway is established by the Board under the policy of the President. Rate structures are complex subjects even under the circumstances of relative simplicity as obtained with the Burma Railway. However, the problem is not limited to the Railway itself; the larger problem to be analyzed is the establishment of a proper and adequate rate structure for the Railway which is in fact balanced and coordinated with similar proper and adequate rate structures for other common carriers in Burma. The field is too complex and broad for treatment in a preliminary report and will accordingly be dealt with in the comprehensive report.

J. CURRENT AND SPECIAL PROBLEMS.

1. GENERAL. Railway operations are currently impeded by the physical damages sustained in their position as a continual target of insurgency. The manifest excellent spirit of railway employees in working aggressively to restore the railway to effective operation is noteworthy. The publication of complete schedules has been suspended. Fulfillment of train runs on schedule is low. Interruption of operation and uncertainties of service are relatively numerous. Night operation is suspended as impractical. Actual train speeds are about half of normal. Gaps at important river crossings require ferry transfer, expensive in rupees and time. Some operating areas are cut off from contact with the main line by intervening portions of lines held by insurgents. These conditions make relatively high operating costs and relatively low revenue return.

2. REHABILITATION OF PHYSICAL PLANT AND ROLLING STOCK. The most pressing obligation of the Board is the rehabilitation of the physical plant and rolling stock of the railway. The Government-in-exile in Simla prepared a plan for this purpose which was followed in substantial part after WW II. The Simla plan has been superseded by a plan of the Board which has necessarily gone through successive refinements and adjustments, until the current plan established in April of 1951 was adopted. A copy of this plan appears as Appendix B at the end of this Section. It is comprehensive, and does not and should not itemize details. Rehabilitation is planned in 2 phases—the first and most urgent being Phase I for accomplishment in 3 years and the bulk but not all of the additional work required for complete rehabilitation being set out in Phase II for accomplishment in the succeeding 5 years. Such phasing is mandatory to provide time necessary for actual procurement of material and the performance of construction work; it permits the spreading of costs through a period of years, also essential. The following comments pertain to this plan:

a. Certain items contained in Phase I are discussed in comparative detail in other parts of this Section, such as the Anin-Ye track rehabilitation, procurement of diesel mechanical shunters, workshop machinery, and the Ava and Sittang bridges. Other items in this Phase have been completed, or completed in part, such as the Gokteik viaduct, some of the minor bridges, erection of many buildings and certain items in signals and telegraphs.

b. Phase II continues certain items of work scheduled in Phase I and carries forward the general schedule of rehabilitation. Certain items in Phase II are discussed in other parts of this Section, such as the Alon-Ye-U and the Pegu-Thongwa branch lines, diesel mechanical shunters, and 3 coach diesel electric trains.

c. Throughout the entire program of rehabilitation the outstanding deficiency and greatest need is that relating to steel, whether in the form of rail, rolled shapes for trusses and girders, girders and trusses as complete units, or material for stock for shopwork.

d. The work scheduled in Phase I is on the whole well conceived and planned and should be substantially followed. The program should be adjusted from time to time as implementation takes place to take changing conditions into account.

3. TRAINING. The annual reports for the last two years indicate an increasing emphasis on the subject of training. The annual report for 1949-50 indicates a program of instruction organized and operated by the Railways covering subjects in traffic, civil engineering, mechanical engineering, operations, and in accounts and audit. Part of the instruction was attained through the medium of the Burma Oil Company's engineering evening classes at the University College; part was conducted by the Railways directly. The training involved various categories of personnel extending to many employees in the lower categories. The Railways actually suffer from scarcity and inadequacy of the number of thoroughly-trained and qualified technically-skilled and semi-skilled personnel. The Burmanization policy has taken and continues to take

a heavy toll in experienced and qualified technicians. It appears that not enough men are being graduated from the colleges to bring into the Railways the volume of technically-trained persons needed in the gazetted list. It is not apparent that the efforts of the Railways or the various trade and technical schools of Burma are providing a number of technically-qualified persons adequate to the needs of the Railways. A broad discussion of the training problem as a whole is contained in Section II of this report and is generally applicable in this discussion of training needs. It is believed that this subject is one of such magnitude and importance that it merits the faithful analysis and evaluation of all ways and means to develop a training program in terms of formal and on-the-job training broad enough in scope to provide the numbers required to cover attrition of personnel and to augment technical personnel currently employed by the Railway.

4. TICKET-LESS TRAVEL. During 1949-50, 58,000 passengers were apprehended traveling without tickets or with irregular tickets. Such practices were detected by the use of "flying squads", traveling ticket inspectors in districts, and a special squad in the Rangoon suburban area, in addition to traveling ticket examiners and ticket collectors. In spite of these positive efforts, there has been no improvement in the position with respect to ticket-less travel. Where members of the railway staff have been found at fault in ticket-less travel, drastic action has been taken against them. Although the number of persons so traveling in 1949-50 is less than 1 per cent of the total passengers carried during that year, it would seem unlikely that more than a minor part of persons so traveling were in fact detected. To the extent that railway staff is involved in ticket-less travel, the implication is one of real seriousness. It would seem clear that this irregular practice stems in large part from public attitudes generated by war and insurrection. It is equally clear, however, that the Railways should collect proper revenue for services rendered. It is believed that this problem is one of sufficient significance to warrant a thoroughly critical analysis of the mechanisms which permit passengers to travel without tickets, or irregular tickets, that such investigation should be expedited, and that vigorous action should be taken toward its remedy.

5. BRANCH LINES.

a. The Rangoon-Mandalay line normally produces approximately 42% of the total revenue; in like fashion the Rangoon-Prome line produces 22%. These two main lines together produce nearly 2/3 of the total revenue. The remaining lines therefore produce a little over 1/3 of the total revenue. This may be expressed by saying that 28 percent of the total route mileage produces nearly 2/3, whereas 72% of the total route mileage produces a little over 1/3 of the total revenue. This in itself suggests examination of the less-productive lines from a business standpoint for determination of retention or abandonment of such branch lines.

b. It appears that the Moulmein-Ye line has in each year of its existence produced an operating loss, and larger losses than any other branch line. The Pegu-Thongwa branch, the Alon-Ye-U branch and the Myingyan-Paleik cord line likewise are reported to have produced significant annual losses.

c. The location of the Moulmein-Ye line is such as to create positive doubt as to its future need in the transportation system of Burma. It is located in the upper part of the Tenasserim Division which, south of the Salween River, has a length of 420 miles, an average width of about 60 miles, is bounded on the east by mountains and hills and on the west by the Andaman Sea. This "peninsula" is separated from the rest of Burma by the Salween River, impractical to bridge. The population density in this area runs from about 80 per square mile in the Amherst District to 16 per square mile in the Mergui Districts with nearly all of the population concentrated in the lowlying lands adjacent to the Andaman Sea. The trend of population as shown by comparing the records of 1941 with 1931 shows, for that decade, a 13% increase in the Amherst District, 15% in the Tavoy District, and 7% in the Mergui District. There is an all-weather road from Moulmein south to Mergui except for approximately 50 miles from Thanbyuzayat to Ye, which is a fair weather road. It is understood that the Buildings and Roads Department has a long-range plan to build a national trunk road from Moulmein south to Victoria Point, or the vicinity thereof. Furthermore, this area is served by the adequate ports of Moulmein, Mergui and Tavoy, between which there is considerable coastal traffic and from which there is some traffic to Rangoon and foreign ports. The coastal traffic of Moulmein, Tavoy and Mergui is now about 40% of Burma's total coastal traffic, and ocean shipping from these ports represents some 4% of Burma's total. In a physical situation of this sort the existing highway tends to attract short-haul traffic. As the highway is improved and finally developed into a National Trunk road, and as vehicle population increases, an increasing percentage of carriage and goods transport business will go by highway. As the Ports of Moulmein, Tavoy and Mergui are further developed and improved, it is most probable that an increasing percentage of the transport business will go by water. It is believed that the combination of highway and water transportation modes, already competitive, will absorb more and more of the total business. It is important to note that the Moulmein-Ye branch line has never enjoyed business other than local, which is fundamentally short-haul, except for a relatively small volume of long-haul traffic in salt moving into upper Burma. This long-haul trade could be car-

ried from the minor ports to Rangoon and then by rail to Upper Burma. It is believed that the present loss-producing performance of this branch line will tend to deteriorate, and that the need for and utility of this branch line will become increasingly questionable. There appears to be no present need for this branch line, from the standpoint of transportation. Its future need is even more doubtful. It is accordingly recommended that it be abandoned, and that the conversion of its right-of-way to the Buildings and Roads Department use be considered, where appropriate.

d. From a somewhat different set of facts the Pegu-Thongwa branch line appears also to have outlived its usefulness. Inasmuch as it is understood that the Government has directed that the railroad from Pegu to Thongwa be dismantled and that the right-of-way be turned over to the Buildings and Roads Department for the construction of a "jeepable road", discussion is inappropriate.

e. The Mandalay-Madaya line runs north from Mandalay a distance of 18 miles. The records indicate that it carries almost no goods and depends therefore all but entirely on Carriage traffic for its revenue. The Alon-Ye-U branch line running north by east from Alon has consistently produced annual operating deficits pre-WW II. It was dismantled by the Japanese and has not been restored. It is recommended that a critical analysis of all factors bearing on the present and probable future need for these lines be made, taking into account the present and prospective proper competition from other transportation modes, with a view to determining abandonment or rehabilitation and continued operation.

f. The Myingyan-Paleik cord line and the Taungdwingyi-Kyaukpadaung branch line have likewise consistently produced operating deficits in past years. These lines are located in the most densely populated part of Burma, where the trend of population increase is also greater than average. These branch lines when built were regarded as a part of a future direct connection from Mandalay to Rangoon through Allanmyo and Prome into an alternate line from Mandalay to Rangoon. These lines were dismantled by the Japanese and require rebuilding if they are to be used. It is recommended that all facts bearing on these questions be adduced, analyzed and evaluated from the long-term viewpoint, and a decision reached as to the abandonment or rehabilitation of these lines.

6. MINGALADON-INSEIN CONNECTION. The suburban traffic into Rangoon is normally of considerable quantity and importance. This service should be improved. The flexibility of suburban train operation and the economy of operations would apparently be enhanced by the construction of a 3½ mile line connecting Mingaladon with Insein. It is believed that this has such probable value as to warrant full investigation.

K. CONCLUSIONS AND RECOMMENDATIONS.

The Burma Railways were a natural and sustained target during WW II, not only for destruction of vital installations by the allied forces, but also for warping of the system as a whole to suit military concepts by the Japanese. After substantial rehabilitation following WW II, the insurrection in the spring of 1948 has again created wide destruction of sensitive railway facilities, costly to restore; impeded physical improvement; and prohibited normal service. This process of destruction and interruption of service continues to date, but at a diminishing rate. Until law and order shall have been re-established, neither cost nor time of rehabilitation can be accurately computed. Rehabilitation of the main line and principal branches to pre-WW II physical condition and operating standards should be the goal, leaving branch lines heretofore so little used as to be unprofitable to abandonment or lower priority in reconstruction. No new extensions are currently indicated. Even this plan is quite costly in capital investment, estimated by the Board to require nearly 50 crore. From its early history, the railway has consistently lifted a vital and impressive share of Burma's transportation in Goods and Passengers. Even with Inland Waterway competition, and in the presence of Airway and Highway competition which it must soon face in serious degree for the first time, it will remain an essential transport mode in the expanding economy of Burma. It must adjust itself realistically to this opportunity and obligation. Consistent with this objective, it is recommended:

1. That the rehabilitation of the physical plant and rolling stock be accomplished substantially as given in the appendix to this Section.

2. That every practicable effort be made to expedite the repair of the Ava Bridge and the construction of the Sittang Bridge, which serve highway as well as railway requirements and are vital in connecting operating segments of the railway.

3. That the training of executives and technicians be enhanced to a marked degree in scope of personnel, subject and method.

4. That the introduction of power tools in shop practice and in field construction and maintenance be enhanced to the maximum extent.

5. That a full analysis be made of the necessary revision of procedures and practices to eliminate ticket-less travel.

6. That the following branch lines be abandoned:

a. Pegu-Thongwa*

b. Moulmein-Ye

---

*It is understood that the GUB has directed the abandonment of this branch, and the conversion of the bund and right-of-way to the Buildings and Roads Department for construction of a highway.

7. That a detailed analysis be made of all factors pertaining to the need for and usefulness of the following branch lines, including actual and prospective competition by other transportation modes for specific determination of abandonment or lowest priority rehabilitation:

a. Taungdwingyi-Kyaukpadaung
b. Myingyan-Paleik
c. Alon-Ye-U
d. Mandalay-Madaya

Appendix B

PHASE I

WORKS TO BE COMPLETED DURING THE NEXT 3 YEARS

I. TRACK

(a)

Pyinmana-Tatkon	28	miles
Lewe-Kyaukpadaung	129	"
Ywataung-Alon	70	"
Anin-Ye	32	"
Danbi-Kyangin	52	"
Neikban-Daga	51	"
Nawnghkio-Nawngpeng	16	"
Sittang Retirement	19	"
Total	397	miles

(b) Procurement of 440 track miles of rails and fastenings.

(c) The restoration of the double track from Togyaunggale (mile 7¼) to Shwehle (mile 51¾) on the main Rangoon-Mandalay line.

II. BRIDGES

(a) In addition to the three well-known bridges, i.e., Gokteik Viaduct, Ava and Sittang, the following bridges will either have to be repaired or rebuilt:

	Number
Bridges with spans of over 100 feet	4
Bridges with spans of over 60 to 100 feet	45
Bridges with spans of less than 60 feet	195
	244

(b) Procurement of approximately 5,000 tons of steel for the reconstruction of Sittang Bridge.

(c) Procurement of approximately 1,000 tons of Bailey bridging material for emergency repairs.

(d) Procurement of 400 tons of 40 feet and 60 feet bridge girders.

III. BUILDINGS

Apart from Rangoon Station, Insein and Myitnge Workshops, the construction of which are at present in progress, 4,500 units of buildings inclusive of service buildings of all description and staff quarters of different types, still remain to be built.

IV. SIGNALS AND TELEGRAPHS

78 Stations on the Main line and 254 stations on the Branch lines will have to be installed with appropriate type of signalling arrangements as mentioned in the report.

V. LOCOMOTIVES

(a) Locomotive fittings and 5 spare boilers for WD MacArthur engines to be purchased.

(b) Procurement of 6 Diesel Mechanical Shunters.

VI. CARRIAGES

(a) Construction of 200 Third Class Carriages, materials for which have already been received.

(b) Purchase of 100 Upper Class Carriages complete with fittings either from the U.K. or Japan, for which negotiations are now in hand.

(c) Building new bodies for 17 new under-frames which have already been received. These are required for use in local rakes.

(d) Rebuilding of State Saloons and 24 Inspection Carriages.

(e) Procurement of 3,000 numbers of Rolled Steel Wheels.

VII. WAGONS

(a) Rehabilitation of 1,500 wagons which were damaged during the war.

(b) Assembling of 500 wagons, parts for which have already been received.

VIII. WORKSHOP MACHINERY

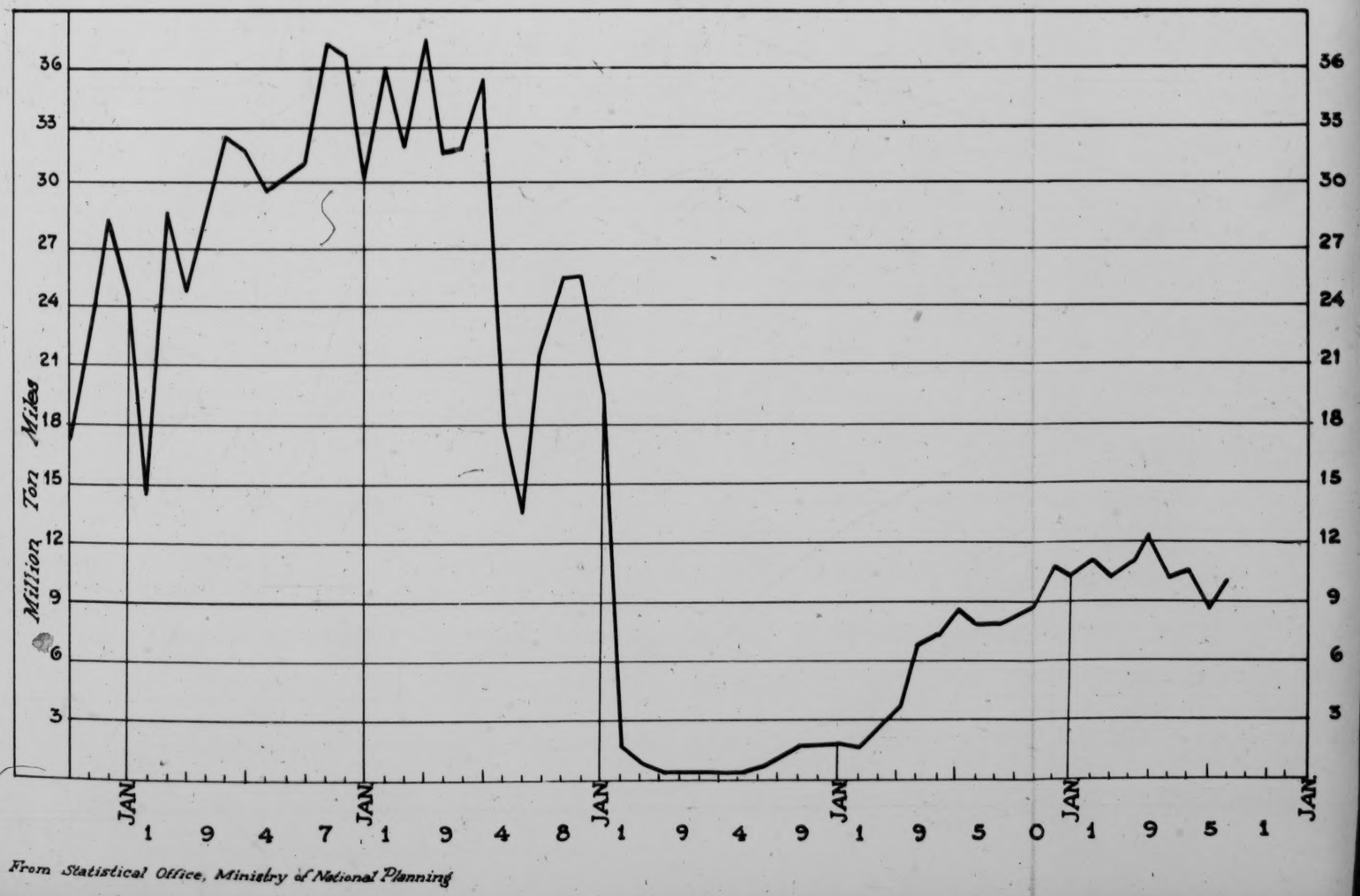
Installation of the remaining Workshop machinery and Power House equipment. About 75 per cent of the new machines have already been installed, and 25 per cent still remains to be done.

IX. ELECTRICAL EQUIPMENT

Procurement and rehabilitation of electrical fittings of carriages and locomotives, both new and old. For this work 100 train lighting dynamos 24/36 V, 2,400 train lighting cells and a considerable length of electric wires will be required.

FREIGHT CARRIED BY BURMA RAILWAYS

(IN MILLION TON MILES)



From Statistical Office, Ministry of National Planning

NOTE:-

DE = District Engineer

AEN = Assistant Engineer

CHIEF ENGINEER

- Personal Assistant, AEN
- Deputy Chief Engineer
  - AEN (Drawing Office) Head Office
  - AEN (Henzda Independent Sub-Division)
- Deputy Chief Engineer (Signals & Telegraphs)
  - DE (Signals & Telegraphs)
    - Rangoon
  - AEN (Signals)
  - AEN (Telegraphs)
- Deputy Chief Engineer (Bridges)
  - DE (Bridges) Head Office
- DE (Stores) Head Office
- DE (Open Line Districts)
  - 2 AEN
    - Pegu
    - Toungoo
    - Mandalay
    - Shwebo
    - Rangoon

TRAFFIC MANAGER

- Deputy Traffic Manager (Transportation)
  - Assistant Superintendent (Transportation)
- Superintendent, Personnel & Stores
  - Assistant Superintendent, Head Office
  - Assistant Traffic Superintendent Independent Charge
    - Maymyo
    - Thaton
    - Henzada
- Deputy Traffic Manager (Commercial)
  - Assistant Superintendent (Claims)
  - Assistant Traffic Superintendent Independent Charge
    - Maymyo
    - Thaton
    - Henzada
- Superintendent, Rates & Fores
  - Assistant Superintendent, Head Office
- District Traffic Superintendent
  - Assistant Traffic Superintendent
    - Rangoon
    - Lower
    - Toungoo
    - Mandalay
    - Ywataung

CONTROLLER OF STORES

- Deputy Controller
  - 2 Assistant Controllers of Stores

UNION OF BURMA RAILWAY BOARD

CHAIRMAN OF THE BOARD
CHIEF EXECUTIVE OFFICER

GENERAL MANAGER

AUDITOR GENERAL
GOVERNMENT OF THE
UNION OF BURMA

CONTROLLER OF STORES

- ...puty Controller
- 2 Assistant Controllers of Stores

DEPUTY GENERAL MANAGER

- Secretary
  - Assistant Secretary
  - Statistical Officer

CHIEF MEDICAL OFFICER

- 3 District Medical Officers
  - Insein
  - Toungoo
  - Mandalay

CHIEF MECHANICAL ENGINEER

- Personal Assistant
- Deputy Chief Mechanical Engineer (Carriage)
  - Works Manager (Carriage)
  - Assistant Works Manager
- Chief Electrical Engineer
  - Electrical Engineer
  - 2 Assistant Electrical Engineers
- Deputy Chief Mechanical Engineer (Locomotive)
  - Works Manager (Locomotive)
  - Assistant Works Manager
  - Production Engineer (Insein Workshops)
  - Locomotive Running Superintendent
  - District Mechanical Engineer
  - Assistant Mechanical Engineer
    - Rangoon
    - Toungoo
    - Mandalay

CONTROLLER OF RAILWAY ACCOUNTS

- Deputy Controller of Railway Accounts
  - Senior Accounts Officer
  - 5 Junior Accounts Officers

BURMA

RAILWAYS

LEGEND

RAILWAY LINE UNDER TRAFFIC.

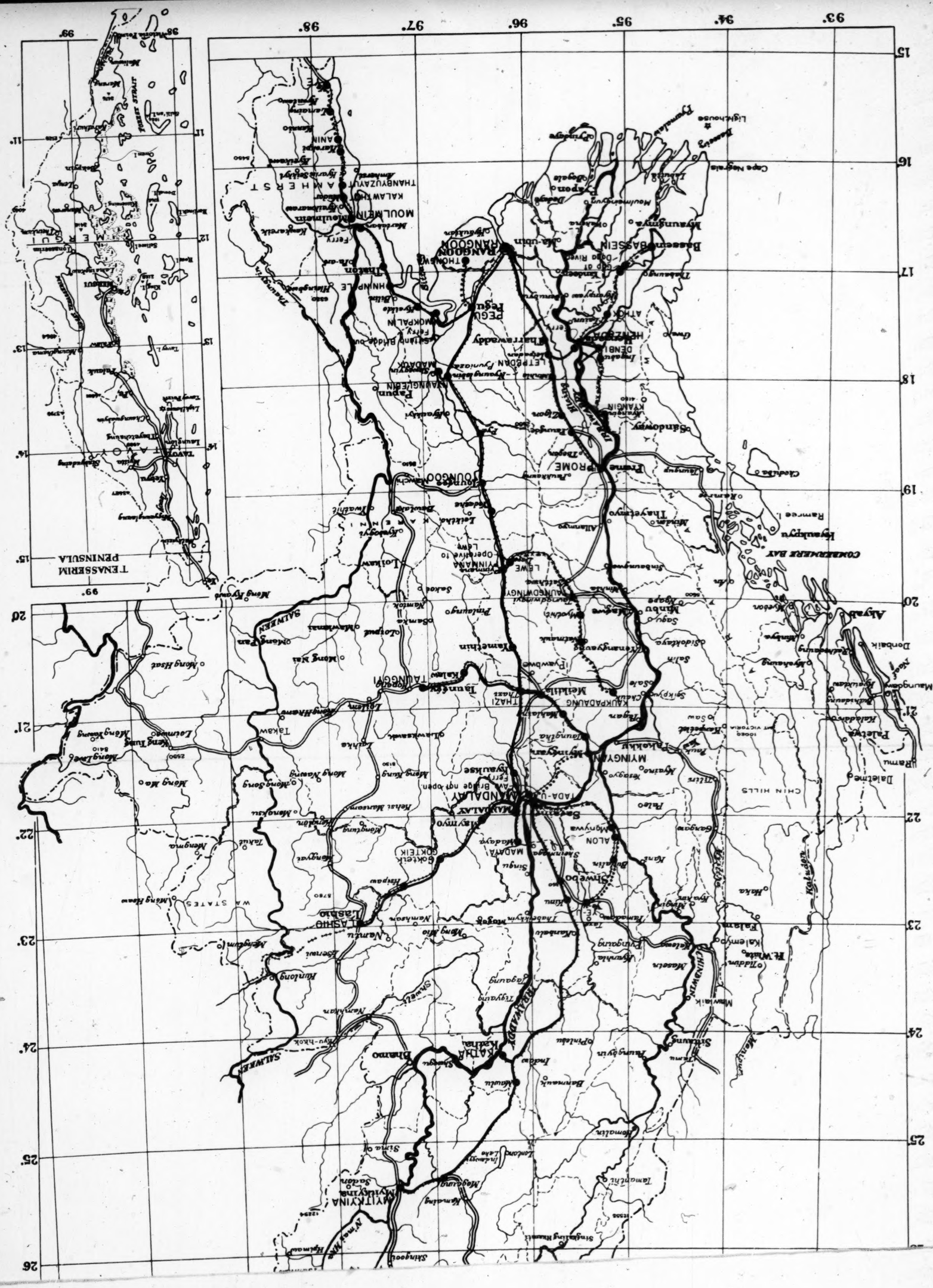
RAILWAY LINE IN HANDS OF INSURGENTS OR DAMAGED BY INSURGENTS.

RAILWAY LINE DISMANTLED BY JAPS AND NOT YET REPLACED.

92° 93° 94° 95° 96° 97° 99° 100° 101°

28° 27° 26° 25° 24° 23° 22° 21° 20°

Kumjawng Pass
Tari Wang
Putao (Fort Hertz)
Chau Kan
Zawng
Hkalta
Hkading
Rang Seng
Triangle
Hukawng Valley
Changyeg
Malinkwan
Shingoot
Tsumpaw
Hpimaw
Singkaling Hkamti
Tamanthi
Kamaing
Myitkyina
Sadon
Indawgyi Lake
Lonton
Sima
Homalin
Banmauk
Mawlu
Indaw
Shwegu
Dhamo
SALWEEN
Kyu-hkok
Namhkan
Sittaung
Paungbyin
Pinlebu
KATHA
Katha
IRRAWADDY
Monywa
Mawlaik
CHINDWIN
Tigyaing
Tagaung
Shweli
Kunlong
Tiddim
Ft. White
Kalemyo
Falam
Pyingaing
Kanbalu
Mong Mio
Namtu
Lashio
Hsenwi
Mongyai
WA STATES
Mong Hsaw
Haka
Shwebo
Singu
Hsipaw
Gokteik
GOKTEIK
Takut
Mengma
Kalewa
Kyaukse
MANDALAY
Maymyo
Mongtung
Hsenlon
Mongksu
Kehsi Mansam
Mong Nawng
Mong Mao
Mong Lwe
Mong Yawng
CHIN HILLS
Daletme
Ramu
Paletwa
Kaladan
MYINGYAN
Myingyan
Pakokku
Taungtha
Lawksawk
Takaw
Loilen
Mong Hkam
Mahlaing
KAUKPADAUNG
Meiktila
THAZI
Thazi
Taunggyi
TAUNGGYI
Kalaw
Mong Hsat
Mong Nai
Mong Pan
Maungdaw
Donbaik
Akyab
Myohaung
Minbya
Yenangyaung
Yamethin
Pyawbwe
Sidoktaya
Natmauk
Loilem
Mawkmai
SALWEEN
Mong Kyawt
Sagu
Minbu
Magwe
Myothit
Pinlaungo
Samka
Namtok
Taungdwingyi
TAUNGDWINGYI
Sakoe
Loikaw
KYAUKSE
Operative to Leiwe
LEIWE
COMBERMERE BAY
Kyaukpyu
Allanmyo
Leiktha
Kyaukgyi
MARENGI
TENASSERIM PENINSULA


TENASSERIM
PENINSULA
PEGU
Pegu
PROME
Prome
THAYETMYO
MYINGYAN
MANDALAY
MADAYA
SAGAING
MONYWA
SHWEBO
KATHA
MYITKYINA
TAUNGGYI
KYAUKSE
MEIKTILA
MINBU
ALON
BASSEIN
HENZADA
THONGWA
RANGOON
MOULMEIN
THAGON
HINNAPLE
MOKPALIN
THAYETTAUNG
LETPEDAN
MADAUK
PAUNGLEBIN
TAVOY
MERGUI
ARAKAN
YOMA
CHIN HILLS
SALWEEN
COMBERMERE BAY
FOREST STRAIT
Cape Negrais
Light-house
Ramree I.
Sandoway
Kyaukpyu
Akyab
Donbaik
Mayu R.
Daletme
Ramu
Palewa
Kaladan R.
Mraungdaung
Myebon
Kyaukpyu
Thayetmyo
Minbu
Sagu
Magwe
Yenangyaung
Salin
Pakokku
Myaing
Pauk
Yesagyo
Myatmo
Myaungmya
Bassein
Thabaung
Henzada
Atkyo
Hmawbi
Hlegu
Thaton
Mokpalin
Hinnaple
Moulmein
Amherst
Thagon
Kalawtaung
Thanbyuzayat
Tavoy
Mergui
Tenasserim
Kyaukse
Meiktila
Taunggyi
Loilem
Mawchi
Loikaw
Lewe
Yinmabin
Operative 10
Launglon
Pyinmana
Thayetmyo
Allanmyo
Myede
Ramree I.
Cheduba
Sandoway
Kyaukpyu
Akyab
Donbaik
Mayu R.
Daletme
Ramu
Palewa
Kaladan R.
Mraungdaung
Myebon
Kyaukpyu
Cape Negrais
Light-house
Myaungmya
Bassein
Thabaung
Henzada
Atkyo
Hmawbi
Hlegu
Thaton
Mokpalin
Hinnaple
Moulmein
Amherst
Thagon
Kalawtaung
Thanbyuzayat
Tavoy
Mergui
Tenasserim
Kyaukse
Meiktila
Taunggyi
Loilem
Mawchi
Loikaw
Lewe
Yinmabin
Operative 10
Launglon
Pyinmana
Thayetmyo
Allanmyo
Myede
Ramree I.
Cheduba
Sandoway
Kyaukpyu
Akyab
Donbaik
Mayu R.
Daletme
Ramu
Palewa
Kaladan R.
Mraungdaung
Myebon
Kyaukpyu
Thayetmyo
Minbu
Sagu
Magwe
Yenangyaung
Salin
Pakokku
Myaing
Pauk
Yesagyo
Myatmo

MINISTRY OF PUBLIC WORKS & LABOUR

CHIEF ENGINEER, BLDG. AND ROADS

- S.E. PEGU
  - EE RANGOON
    - (3) WEST
    - (3) EAST
  - EE PROME
    - (4) SOUTH
    - (3) NORTH
    - (3) THAYETMYO
  - EE INSEIN
    - (4) EAST
    - (3) WEST
    - (3) HOSPITAL
    - (3) NO. I
    - (3) NO. II
    - (2) NO. III
    - (3) INSEIN
    - (2)
    - (3) HMAWBI
    - (4) THARRAWADDY
  - EE MAGWE
    - (2) MINBU
    - (4) MAGWE
    - (3) YENAGYAUNG
- S.E. PROME
- S.E. TENASSERIM
  - EE MERGUI
    - (3) HD. QRS.
    - (2) PALAW
    - (3) HD. QRS.
    - (3) NORTH
  - EE TAVOY
  - EE AMHRST
    - (5) HD. QRS.
    - (2) KAWKAREIK
    - (5) HD. QRS.
    - (2) PAPUN
  - EE THATON
- S.E. MARITIME
  - EE BASSEIN
    - (2) HD. QRS.
    - (2) YEGYI
    - (4) HENZADA
  - EE PEGU
    - (3) HD. QRS.
    - (3) NYAUNGLEBIN
    - (2) SOUTH
  - EE KYAUKPYU
    - (3) HD. QRS.
    - (2) SANDOWAY
  - EE AKYAB
    - (5) HD. QRS.
    - (2) BUTHIDAUNG
  - EE DELTA
    - (4) MA-UBIN
    - (3) HANTHAWADDY
- S.E. SAGAING
  - EE LOWER CHIND.
    - (4) HD. QRS.
    - (2) SAGAING
    - (2) WEST
  - EE UPPER CHIND.
    - (3) KALEWA
    - (2) HOMALIN
  - EE SHWEBO
    - (4) HD. QRS.
    - (3) KATHA
    - (2) MOGOK
  - EE PAKOKKU
    - (3) HD. QRS.
    - (3) SEIKPYU
    - (2) GANGAW
  - EE CHIN PUB. WKS.
    - (2) NORTH
    - (2) SOUTH
- S.E. MANDALAY
  - EE MANDALAY
    - (3) HD. QRS.
    - (3) MAYMYO
    - (3) KYAUKSE
    - (3) WEST
  - EE MEIKTILA
    - (4) HD. QRS.
    - (3) YAMETHIN
    - (3) MYINGYAN
  - EE TOUNGOO
    - (4) HD. QRS.
    - (3) PYINMANA

LEGEND:
- S.E. SUPERVISING ENGR.
- E.E. EXECUTIVE ENGR.
- S SUB DIVISION OFFICER
- (1) SUB ASST. ENGR.

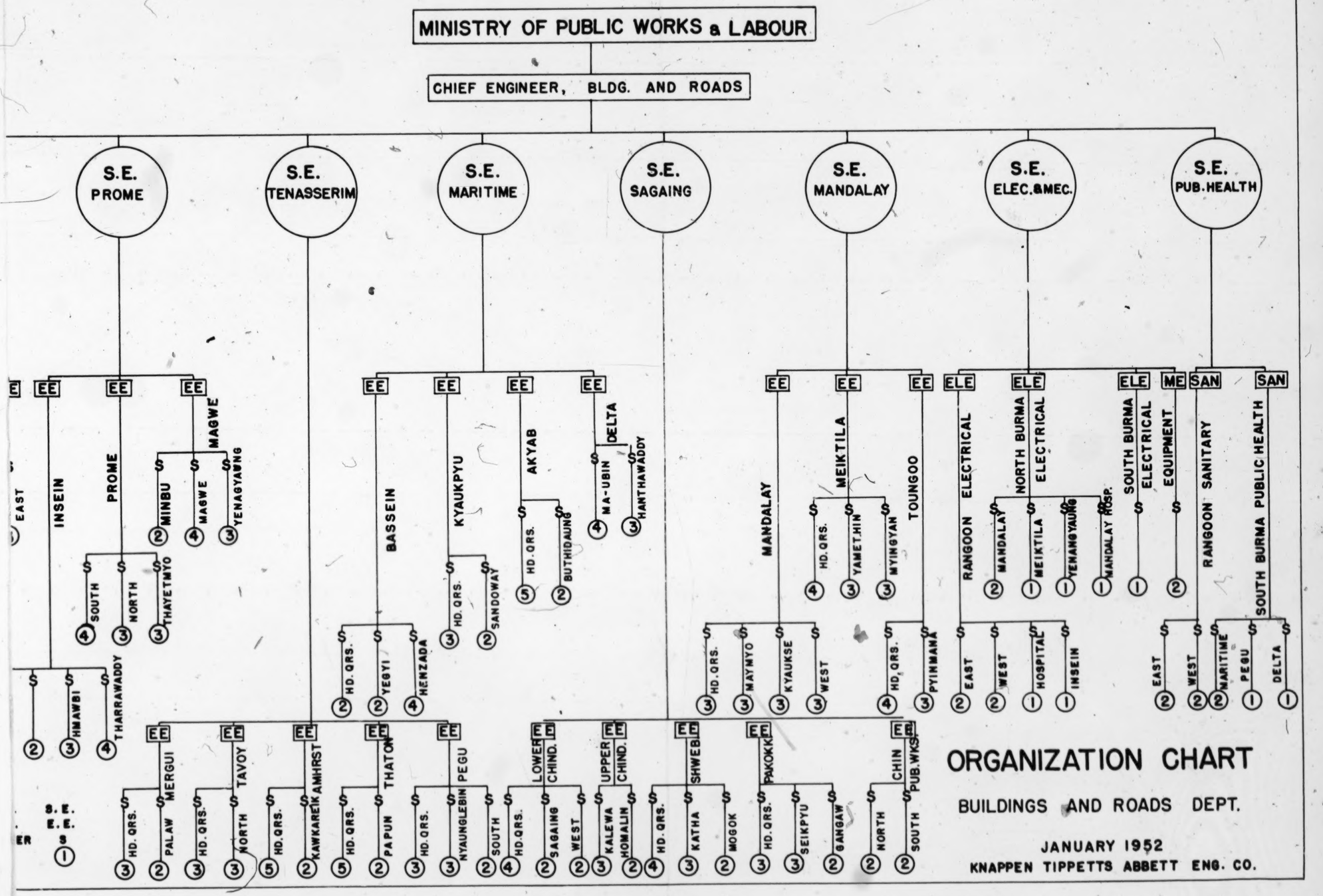

MINISTRY OF PUBLIC WORKS & LABOUR
CHIEF ENGINEER, BLDG. AND ROADS
S.E. PROME
S.E. TENASSERIM
S.E. MARITIME
S.E. SAGAING
S.E. MANDALAY
S.E. ELEC.&MEC.
S.E. PUB.HEALTH
EE
INSEIN
HMAWBI
THARRAWADDY
PROME
SOUTH
NORTH
THAYETMYO
MINBU
MAGWE
YENANGYAUNG
BASSEIN
HD. QRS.
YEGYI
HENZADA
KYAUKPYU
SANDOWAY
AKYAB
BUTHIDAUNG
DELTA
MA-UBIN
HANTHAWADDY
MANDALAY
MAYMYO
KYAUKSE
WEST
MEIKTILA
YAMETHIN
MYINGYAN
TOUNGOO
PYINMANA
ELE
RANGOON ELECTRICAL
EAST
WEST
HOSPITAL
INSEIN
NORTH BURMA ELECTRICAL
MANDALAY
MEIKTILA
YENANGYAUNG
MANDALAY HOSP.
SOUTH BURMA ELECTRICAL
ME
EQUIPMENT
SAN
RANGOON SANITARY
MARITIME
SOUTH BURMA PUBLIC HEALTH
PEGU
DELTA
MERGUI
PALAW
TAVOY
NORTH
KAWKAREIK AMHRST
THATON
PAPUN
PEGU
NYAUNGLEBIN
SOUTH
LOWER CHIND.
SAGAING
WEST
UPPER CHIND.
KALEWA
HOMALIN
SHWEBO
KATHA
MOGOK
PAKOKKU
SEIKPYU
GANGAW
CHIN
NORTH
SOUTH
PUB.WKS.
EAST
ORGANIZATION CHART
BUILDINGS AND ROADS DEPT.
JANUARY 1952
KNAPPEN TIPPETTS ABBETT ENG. CO.

CHART SHOWING LENGTHS OF NOTIFIED MAIN ROADS AND DISTRICT ROADS (Including Deputy Commissioner's Local Fund)

FOR THE YEAR 1949-50

NAME OF CIVIL DISTRICT	MAIN ROADS						DISTRICT ROADS					
	Tarred	Metalled	Surfaced	Earth	Mule	Lengths as per revised Notification	Tarred	Metalled	Surfaced	Earth	Mule	Lengths as per revised Notification
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Akyab	16	5	20	24	44	109	...	...	26	28	2	56
Amherst	81	4	152	89	...	326	25	14.5	20	...	...	59.5
Arakan Hill Tract	...	...	...	...	...	...	...	...	...	...	87	87
Bassein	60	2	...	...	...	62	17	10	33	...	16	76
Chin Hills	...	...	...	...	505	505	...	...	...	...	...	...
Hanthawaddy	43	...	14	...	...	57	7	...	60.5	...	...	67.5
Henzada	21	...	...	62	...	83	12	...	54	16	46	128
Insein	121	...	8	...	...	129	28	15	28	3	...	74
Katha	60	17	128	...	...	205	7	14	11	64	4	100
Kyaukpyu	...	6	3	11	10	30	...	...	1	20	...	21
Kyauksè	65	2	...	33	...	100	...	2	2	83	...	87
Lower Chindwin	32	60	1	60	...	153	...	...	21	44	18	83
Magwe	147	12	...	40	...	199	...	4	2	41	...	47
Mandalay	77	30	6	33	...	146	4	3	...	16	...	23
Maubin	14	...	...	6	...	20	...	...	34	...	...	34
Meiktila	115	46	...	...	...	161	...	3	46	112	...	161
Mergui	10	1	...	123	...	134	...	1	4	18	...	23
Minbu	14	9	50	101	...	174	...	...	57	31	...	88
Myaungmya	...	...	...	...	...	...	4	...	43	...	...	47
Myingyan	71	96	...	37	...	204	...	1	4	125	...	130
Pakôkku	8	42	12	286	13	361	...	...	...	100	...	100
Pegu	135	...	4	15	...	154	...	4	44	27	58	133
Prome	74	...	...	50	4	128	24	...	56	13	14	107
Pyapôn	...	...	...	...	...	...	3	...	27	...	...	30
Rangoon Town	...	...	...	...	...	...	...	...	...	...	...	...
Sagaing	44	47	13	33	...	137	...	2	84	11	...	97
Salween	...	...	27	46	21	94	...	...	...	97	...	97
Sandoway	15	22	...	117	...	154	...	...	10	...	...	10
Shwebo	118	50	23	107	...	298	...	5	38	199	...	242
Tavoy	51	32	121	...	...	204	6	9	...	82	...	97
Tharrawaddy	73	...	9	...	...	82	63	25	28	5	...	121
Thatôn	117	13	34	26	...	190	7	28	47	18	...	100
Thayètmyo	46	49	...	10	...	105	...	53.5	6	8	...	67.5
Toungoo	88	29	11	47	17	192	...	8	26	37	77	148
Upper Chindwin	...	...	11	173	...	184	...	3	20	43	34	100
Yamèthin	115	23	...	...	...	138	3	10	20	80	...	113
Total ...	1,831	597	647	1,529	614	5,218	210	215	852.5	1,321	356	2,954.5

NOTE – The above statement does not include the following notified Union Highways:–

(a) Portion of Rangoon, Mandalay, Lashio, Bhamo, Myitkyina Union Highway lying in Shan States	271	Miles
(b) Portion of Rangoon, Mandalay, Lashio, Bhamo, Myitkyina Union Highway lying in Kachin States	167	"
(c) Myitkyina – Ledo Road from Myitkyina passing through Shingbwiyang up to Pangsan Pass	228	"
(d) Myitkyina – Sailaw, Sadon, Wawchon, Kaulaing Hkyet (Cambaiti)	103	"
	769	

The portions of Rangoon, Mandalay, Lashio, Bhamo, Myitkyina Union Highway lying in Burma proper is 488 miles long and is included under "Main Roads" in the above Statement.

(e) The Union Highways have to be notified as such by the Government through the Ministry of Public Works Rehabilitation and Labour and for the Main and District Roads, the Notification is issued by the Ministry of Education and Local Government. The Buildings and Roads Departments assumes responsibility only for Union Highways and Main Roads. Thus, it has 5,218 miles plus the 769 miles of the Union Highways in Kachin and Shan States, i.e., a total of 5,987 miles giving about 43 per cent for bituminized (including the 769 miles of Union Highways), 10 per cent of Metalled, 11 per cent of surfaced, 26 per cent of earth and 10 per cent mule of the total mileage maintained.

G.U.B.C.P.O. – No. 29, M. of N.P., 14-2-52–200–I.

BURMA

NATIONAL AND MAIN ROADS

NATIONAL ROADS

1 RANGOON-MANDALAY-LASHIO-BHAMO-MYITKYINA
2 RANGOON-PROME-MANDALAY
3 RANGOON-MOULMEIN-MERGUI
4 MANDALAY-SHWEBO-KALEWA-TAMU
5 MEIKTILA-TAUNGGYI-KENG-TUNG
6 MOULMEIN-MYAWADI-SIAM
7 PROME-TAUNGUP ROAD (PARTLY COMPLETED)
8 MINBU-AN-MINBYA-KYAUKTAW ROAD (PROPOSED)

LEGEND

ALL WEATHER ROADS
FAIR WEATHER ROADS

92° 93° 94° 95° 96° 97° 99° 100° 101°
28° 27° 26° 25° 24° 23° 22° 21° 20°

LEGEND

ALL WEATHER ROADS

FAIR WEATHER ROADS

TENASSERIM PENINSULA

SALWEEN

ARAKAN YOMA

CHIN HILLS

CHINDWIN

IRRAWADDY

KALADAN

MYITKYINA

BHAMO

KATHA

MONYWA

PAKOKKU

MAGWAY

MANDALAY

PEGU

THAYETMYO

PROME

HENZADA

THARRAWADDY

BASSEIN

MYAUNGMYA

RANGOON

SANDOWAY

AKYAB

KYAUKPYU

COMMERMERE BAY

PALETWA

KALEWA

FALAM

H.W. WHITE

MAWLAIK

SITAUNG

TAUNGGYI

LOILEM

KENGTUNG

LAIHKA

TAKAW

MONG PAN

MONG HSAT

MONG LANG

MONG LWE

MONG MAO

MONG NAWNG

MONG SONG

MONG KHAM

MONG KAU

MONG KUNG

MONG YAWNG

MONG HSU

MONG KAWK

MONG NAI

LOIKAW

LOILEM

LOTAPA

LOIMWE

LOIKAW

LOIKAW

LOIKAW

PHASE II

WORKS TO BE COMPLETED IN THE FOLLOWING 5 OR 8 YEARS AFTER PHASE I

I. TRACK

(a)

Tada-U-Myingyan	62 miles
Alon-Ye-U	50 "
Pegu-Thongwa	49 "
Total	161 miles

(b) The restoration of the double track from Shwehle (mile 51¾) to Kyungon (mile 175½) on the main Rangoon-Mandalay line.

II. BRIDGES

Completion of Sittang Bridge and all the remaining bridges on the entire system.

III. BUILDINGS

Construction of 2,500 units of Workmen's quarters and those buildings left over from Phase I.

IV. SIGNALS AND TELEGRAPHS

(a) Introduction of VHF Radio control, if found suitable, after a thorough investigation.

(b) Introduction of improved type of signalling, i.e., power signalling between Kemmendine and Insein, and Rangoon and Thingangyun.

V. LOCOMOTIVES

(a) Procurement of 4 Diesel Mechanical Shunters and six 3-coach Diesel electric trains.

(b) Conversion of 50 MacArthur engines into oil-burning if the present experiment proves successful.

(c) Procurement of 1,000 Rolled Steel Wheels.

VI. WAGONS

Procurement of 2,000 Wagons (four wheelers).

Section VIII c

HIGHWAYS

A. GENERAL

1. Highway transportation has been and is becoming increasingly important to the economy of the Union of Burma. Highway transportation can exist only when there has been developed a highway net and there are transportation means to use the facilities provided. In this modern age the latter condition means automotive vehicles—passenger cars, motor vehicles and trucks. Burma had begun to attain this combination shortly after World War I and in substantial quantities prior to World War II. Military considerations essentially controlled highway transportation during World War II, and was accompanied by the neglect of many roads, abuse of others, and the building of certain new roads vital to military operations. After 1945 there was impetus in rehabilitation of roads and augmentation of motor vehicles from Army Surplus stocks. Advances were made, but these advances were largely halted by insurrection which persist to such degree even today that carefully made plans can be executed only in part.

2. THE ROAD TRANSPORT DEPARTMENT. The Road Transport Department of the Ministry of Transport and Communication was organized on 1st December, 1947, and was assigned as its prime functions the liquidation of the Road Transport Board and the maintenance and repair of all the Government-owned vehicles in the Rangoon area. At some time in 1949 the Government Motor Transport pool was assigned to the Road Transport Department along with functions of receipt, issue and control of all Government vehicles throughout Burma. This expanded function includes catering for the emergency needs of Government Ministries and the Army on special occasions. The Road Transport Department has no function with respect to the control or regulation of commercial or other highway traffic.

3. The Board of Management for Road Transport, organized in 1947, as the successor to the Road Transport Board, is chairmaned by the Secretary, Ministry of Transport and Communications, and has as its members the Deputy Secretary of that Ministry, the Secretary of the Ministry of Finance and Revenue and the Executive Officer, Road Transport Department. Its functions are to supervise the liquidation of the Road Transport Board.

4. The regulation and control of highway transportation rests in the Ministry of Transport and Communication. Prior to World War II, highway transportation was quantitatively less important than the older, firmly established Waterway and Railway transportation. Control of vehicular traffic was not a problem at that time, nor has it become of sufficient significance since World War II and particularly since the insurrection to occupy any considerable body of official attention. It is believed, however, that the regulation and control of highway transportation now demands attention, particularly in its commercial aspects, in order to regularize its practices, to encourage it in its natural sphere of transportation, to bring it into a proper competitive position with other transportation modes, and to prevent its improper encroachment upon the natural spheres of railways, waterways and airways as recommended in Section VIII.

B. HIGHWAY ORGANIZATION

1. In about 1894 a Public Works Department was established whose function was principally the construction and maintenance of public buildings, irrigation works and highways. Since that date there have been many organizational changes and adjustments. An excellent road net was developed in the 1920's and 1930's with over 5,000 miles of motorable roads by 1935, at a time when there were approximately 18,000 motor vehicles in Burma. After World War II additional organizational changes were made. At this time the Ministry of Public Works, Rehabilitation and Labor is responsible for the organization

and direction of all matters pertaining to the highway system in the Union of Burma insofar as Union highways and notified main roads are concerned.

2. The Buildings and Roads Department, the principal department of the Ministry of Public Works, Rehabilitation and Labor, is responsible for the construction and maintenance of all highways which are the direct charge of the Ministry. The Chief Engineer is the Executive head of the Buildings and Roads Department and is responsible to the Minister for Public Works, Rehabilitation and Labor through the Secretary of that Ministry for the following functions:

a. Professional advice on all matters relating to the highway system as a whole.
b. Administration of the policies established by the Government.
c. Submission of a program of original works and maintenance to the Government for each fiscal year.
d. Implementation of construction and maintenance programs as approved and funded by the Government.

The Buildings and Roads Department operates as a normal Department of the Government. A chart at the end of this section gives full details of the organization. The Department is divided into 8 Circles, each headed by a Superintending Engineer who is responsible to the Chief Engineer for the administration and professional control of public works within his Circle. Six Circles cover Burma as a whole for the construction and maintenance of buildings and roads, and the remaining two are specialized, being the Electrical and Mechanical and the Public Health Circles which provide the technical work in those specialties for all of Burma. The basic operating unit of the Department is the Division, of which there are from 3 to 5 in each of the six standard Circles. Each Division is headed by an Executive Engineer who is responsible to the Superintending Engineer for the execution and management of all works within his Division. Each Division is in turn divided into sub-divisions, each headed by a Sub-Divisional Officer who is responsible for the management and execution of works in his Sub-Division Area. Each Sub-Division has several sections headed by a Sub-Assistant Engineer (overseer) whose duties are supervisory with respect to work actually under way. This type of organization is schematically, sound and provides for centralized fiscal and policy control and decentralized operations.

3. The Buildings and Roads Department operates on annual appropriations in accordance with standard Government administrative procedures. In March of each year estimates of funds required for maintenance of Union highways and Main roads are prepared by the Executive Engineer of the several Divisions and forwarded through channels for administrative examination and such adjustment as may be required. The Chief Engineer consolidates these estimates into a Departmental budget estimate and presents it to the Ministry of Public Works, Rehabilitation and Labor in the early part of May. After further appropriate administrative action, the budget estimate is ultimately presented to the Parliament through the Ministry of Finance and Revenue in September of each year. Funds as appropriated by the Parliament are made available to the Chief Engineer who in turn allocates them to the Executive Engineers of the several Divisions in accordance with the approved budget. For original major works, which are defined as work estimated to cost more than Rs. 10,000, an initial administrative approval of the basic idea is procured from the Ministry concerned, following which the Executive Engineer of the appropriate Division prepares line plans and estimates which are processed successively through technical sanction to financial sanction by the Works Board, and are then considered by the Works Board for selection for inclusion in budget estimates. Funds are appropriated by the Parliament for original works by specifically named project and are allocated by the Chief Engineer to the Executive Engineer of the appropriate division for the execution of work as planned. Subject to Ministerial approval, the Chief Engineer may reallocate funds within certain limits between approved projects for reasons deemed sufficient to warrant the change.

4. Both maintenance and original works are accomplished by the Divisions under the direct authority of the Executive Engineer. The Superintending Engineers and Chief Engineer exercise supervisory and administrative functions in these respects. Normal maintenance is accomplished through the medium of the Departmental organization itself, in which normally there are sufficient employees to allow for approximately one Coolie per mile of road, with appropriate supervisory personnel. Thus, normal maintenance is accomplished by force account. Major items of maintenance or rehabilitation and original works are performed by contract for which completely detailed procedures are established which result in the award of contract work to the lowest responsible tenderer. Contract work is supervised and inspected for compliance with the terms of the contract by the technical assistants to the Executive Engineer. Any unobiligated balance remaining from funds allotted for original works or repairs which may remain at the end of the financial year lapses, and new appropriations become necessary for the prosecution of unfinished work.

C. EXISTING HIGHWAYS

1. GENERAL. The existing highway system of Burma consists of nearly 6,000 miles of Union highways and main roads constructed and maintained by the GUB, nearly 2/3 of which are motorable in all seasons, the balance only in fair weather. This mileage includes, however, 614 miles

of mule paths, suitable only for animal and pedestrian traffic. There are nearly 3,000 miles of District roads, approximately ½ of which are motorable in all seasons and most of the balance in fair weather only. Here again are mule paths, 356 miles in length, not suitable in any weather for motor vehicles. The Union and Main roads are shown on the map at the end of this section.

The total mileage of roads in the Union of Burma is substantially greater, and was listed by the Public Works Department in 1938 as:

Total bituminous, metalled and surfaced	6,263 miles
Earth, gravel, etc., motorable subject to weather	6,280 miles
Earth, gravel, etc., not motorable	4,522 miles
Total vehicular roads	17,065 miles

In addition to the vehicular roads, there exists a very great mileage of non-vehicular tracks and paths suitable in many cases for ox-carts and in any case for animal and pedestrian travel. These tracks and paths are aligned and built largely by villagers to suit their notions and convenience, and accordingly follow no systematic pattern, nor do they need to do so. However, some of these cart tracks follow routes which take on importance in the normal economic development and expansion of local areas, and are then converted into District roads or even into main roads, under which circumstance the burden of improvement and maintenance is assumed by the District Council or the GUB.

2. The GUB is responsible for the construction and maintenance of Union highways and main roads to the extent and in accordance with such "notifications" as are published. Other roads are the responsibility of Districts or the Autonomous States, or subordinate elements thereof. District councils have certain powers of taxation and certain sources of revenue, but these produce relatively very small sums of money which may be devoted to the construction and maintenance of roads. Under certain conditions the GUB grants funds to the Districts or Autonomous States for road construction, but the grants so made are limited. The consequence of these factors is the relatively great difficulty in funding normal maintenance or new construction of roads in Districts and Autonomous States.

3. CLASSES.

a. The road system is classified on a political basis as follows:

(1) Union highways, sometimes called National highways, are roads connecting the capitals and important towns of the Districts and Autonomous States. The cost of construction and maintenance of these highways is borne by the GUB out of its general revenue.

(2) Main Roads are those whose importance is not confined to a single District, and those connecting a Township or Sub-divisional headquarters with its parent headquarters. Main roads are generally motorable but this is not a prerequisite to designation as Main.

(3) District roads, sometimes called rural or local roads, are those the importance of which is confined to the particular District in which they lie.

(4) Municipal roads, sometimes called urban or town roads, are those which fall within the limits of a municipality.

(5) Village cart tracks, sometimes called village roads, are those whose maintenance is left to the public munificence or voluntary efforts of villagers.

(6) Mule paths are mainly fair weather or seasonal paths for villagers in out-of-way places and are normally suitable for use for pack animals and pedestrians only. There is no definite administrative control over mule paths apart from a limited number and mileage of such paths which have been "notified" as Main roads and are accordingly the proper charge of the GUB.

b. The road system is also classified, largely for Departmental purposes, on a technical or construction basis as defined by the Chief Engineer from time to time for both vehicular and non-vehicular traffic. For vehicular traffic, the construction clasification is as follows:

(1) Bituminous or tar painted, meaning that the road has a travelling suface treated or mixed with tar or bitumen.

(2) Metalled or surfaced road has a travelling surface of substantial thickness, composed of consolidated soling stone, broken stone, laterite, delone, kunkar or similar hard materials or any combination of these materials.

(3) Earth road motorable, fair weather, has for its traveling surface the natural ground cover over which a thin coat of gravel or similar material may have been spread.

(4) Earth road, not motorable, has for its travelling surface the natural ground and is fit for use by carts only. For non-vehicular traffic, the road is given no specific construction classification but the normal political classification of mule path is accepted.

c. A chart at the end of this section shows the mileage of existing roads under their technical classification, under the primary headings of Main roads and District roads. Main roads generally include the Union or National roads; to the extent this is not the case, details are supplied in the footnote at the bottom of the chart. The Buildings and Roads Department is responsible for the maintenance of 5,218 miles of Union highways and main roads in Burma proper plus 769 miles of Union highways in the Kachin and Shan States, a grand total of 5,987 miles; of these 43% are bituminized, 10% metalled, 11% surfaced, 26% earth and the remaining 10% are mule paths. Districts are responsible for the construction and maintenance of District roads. The chart shows a total of 2,955 miles of such roads of which 210 miles are tarred, 215

metalled, 853 surfaced, 1,321 are earth, and 356 are mule paths.

4. CONDITION OF UNION HIGHWAYS AND MAIN ROADS. Many factors combine to render it difficult to compile accurate information on the condition of Union Highways and main roads in the headquarters of the Buildings and Roads Department. Basic records and surveys were lost or destroyed in World War II. Data regarding bridges and other special works were likewise lost. No data can be obtained regarding roads in insurgent-held areas. Depredations of insurgents continue to change data when otherwise brought up to date. On the whole, road maintenance has been forced into severe limitations and the situation is one of inadequate maintenance and in many areas no maintenance at all. A large backlog of rehabilitation and heavy maintenance is accumulating which will come as a tremendous challenge for accomplishment upon the return of law and order.

5. The Burmah Oil Company published a booklet in 1948 entitled "The Motor Roads of Burma" presenting much useful data regarding then existing conditions. Table 1 at the end of this section extracts pertinent data for the Union highways and Main roads. It shows many deficiencies.

D. MAINTENANCE OF ROADS AND 1951-52 ORIGINAL WORKS

1. MAINTENANCE. Maintenance is accomplished by the decentralized organization previously described. The Executive Engineer of each Division has the required authority and alloted funds available for his direct use in accordance with standing procedures. Maintenance is described under three broad zones, as follows:

a. Hilly Zone. Road communication in the hills is mostly by cart tracks or mule paths with roads varying from 8 to 12 feet in width, with single or double cuts through hills, and with side and cross drains. The usual items of maintenance are drainage, clearing landslips and fallen trees, repairing specific damages to roads and bridges caused by erosion, and easing of steep gradients and sharp bends. The working season is from November to April and is accomplished almost entirely by handwork and improvised methods.

b. The Dry Zone. Most of the roads in Burma are in this zone and consist of all types. Maintenance is accomplished during all months of the year. Cart tracks and earth roads are dressed and re-sectioned. Surfaced roads are given patch repair for pot-holes and raveling, with attention to renewal of the wearing course and replacement of chippings, and dressing of the road shoulders. There are numerous changes in this zone. Floods occur every year which erode portions of the road itself, wash away bridges or outflank bridge abutments. No appreciable use is made of mechanical equipment in this zone, the tools generally employed being mamooties, pick axes, cane baskets, tar boilers, pouring cans and brushes and brooms. Steam or diesel rollers are the only items of mechanical equipment generally in use.

c. The Wet Zone. The wet zone is the delta area cut by numerous creeks and streams in which no great lengths of roads have been built. The area is low in elevation and roads generally are on bunds, initially correctly designed to withstand floods but with changing conditions are overtopped in considerable mileage each year with certain portions so damaged as to entail heavy repairs. The principle items of maintenance are jungle clearing, bridge repairs, protective works for roads and bridges, drainage and repairs to road surfaces.

2. FUNDS FOR MAINTENANCE. Funds allotted and expended for maintenance for the past three years are:

	Allotment	*Expenditures*
Fiscal year 1948-49	Rs. 100,00,000	Rs. 43,33,176
Fiscal year 1949-50	68,12,000	66,45,430
Fiscal year 1950-51	70,00,000	74,43,466

For the year 1951-52 provision for maintenance has been made by the appropriation of Rs. 95 lakhs. These sums are insufficient to keep abreast of maintenance requirements. Records since World War II show that ordinary annual maintenance requirements are:

Bituminized	Rs. 2,500 per mile
Surfaced	3,000 per mile
Unsurfaced	1,700 per mile
Earth	900 per mile

Minimum funds for annual maintenance requirements will approximate Rs. 135 lakhs per year. It is abundantly clear that the lack of maintenance and abuse during and since World War II, inaccessibility of large areas for any maintenance in insurgent-held areas, and substandard maintenance of roads in other areas combines into a problem that becomes more one of rehabilitation and major repair than normal maintenance. The rehabilitation of Union highways and main roads is the outstanding problem confronting the Department.

3. DISTRICT ROADS. Little specific data are available relating to the condition of maintenance of District and local roads. It seems unlikely that reassurance can be found in this lack of information. Districts have highly limited funds available for maintenance. The position in Autonomous States is thought to average rather better than that of the Districts. Grants from the GUB have not and were never thought to have been adequate to match actual requirements.

4. ORIGINAL WORKS. Included in the current budget for fiscal year 1951-52 are Rs. 40,35,000 provided for new road and bridge projects or major replacements and improvements. These funds make provision for the initiation of the following specific items:

Description	*Mileage*		*Estimated Total Cost*
All-weather road, Waw to Sittang.....	16	Rs.	1,326,000
Improvement to Zigon-Indar Road.....	60		162,000
Improvement to Prome-Taungup Road....	110		1,65,00,000
Jeepable Road, Thongwa-Kayan Rwy.			1,75,000
Improvement, Penwegon Ananbaw Road..			10,20,000
New Road, Madauk-Shwegyin	4		1,90,000
Jeepable Road, Thanatpin-Kayan			3,42,000
Improvement, Nattangwin-Kyaukkyi Road	16		8,55,000

E. CONSTRUCTION STANDARDS

1. ROADS. The roads of Burma are one-lane, apart from a limited mileage of 2-lane roads in the immediate vicinity of larger cities. The right-of-way is normally 100 feet in width, is fenced, and is equipped with road markers to show miles and furlongs. Sometimes, but not habitually, road signs are provided to warn motorists of possible danger at railroad crossings, sharp curves, etc. The paved surface is nominally 12 feet wide, with 2 feet width of soling on either side. The road shoulders are of earth and 3 feet wide. Most of the bridges are one-lane. Wherever possible berm roads are provided for use by ox-carts. Other specific data are as follows: limiting grade 1 on 30; camber 1 on 40; side slopes 1½ to 1 and 2 to 1; curves, radius of 400 feet desired with a radius of 190 feet limiting; super-elevation 1 on 10; design speed, 30 m.p.h.; minimum sight distance both horizontal and vertical, 800 feet. Overtaking and passing of motor vehicles and the combination of slow-moving ox-carts with fast motor vehicles creates a special problem on a road net of single-lane. Under such circumstances one vehicle has to run onto the road shoulders which constitutes a hazard especially in the rainy season. The time will come when the volume of traffic demands and the financial position of the GUB warrants the construction of a 2-lane highway net. In the meantime this is a problem of special significance and warrants the thoughtful attention of the Buildings and Roads Department to devise and execute means which will ameliorate this hazard.

2. CONSTRUCTION METHODS.

a. The normal construction method for tarred and metalled roads in use at this time consists of the laying of a base course of 6″ to 12″ stone soling, with 4½″ thickness of compacted stone metal of 2″ to 2½″ gauge as wearing course. The wearing course is surfaced with bitumen, or sometimes resurfaced with 1″ to 2″ thickness of graded stone premixed with bitumen. Sometimes the surface is prepared by the application of a 3″ to 4″ thickness of bitumen bound macadam, using 1″ to 1½″ gauge stone metal.

b. The surfaced roads consist of 12″ thickness of laterite or delone soling with 6″ thickness of laterite spalls for the wearing course. The surface is habitually primed and sealed with bitumen.

c. In view of the scarcity of bitumen and its cost, together with the surprisingly high cost of crushed stone, it appears that less expensive and better construction methods should be found. The importance of the subgrade which ultimately carries the traffic load has been overlooked in current designs and construction methods. A properly placed subgrade, firm and capable of uniformly good behavior in changing moisture conditions, requires only a relatively thin flexible pavement to carry present day traffic. The development of a laboratory for the testing of local materials including equipment for all of the normal tests required in soils mechanics is indicated. The development of new designs to make the greatest and most economical use of local material is likewise indicated. These improvements become a challenge to the Buildings and Roads Department, and should be instituted without delay.

3. CONSTRUCTION EQUIPMENT. The Buildings and Roads Department has heretofore used in the construction and maintenance of roads the following classes of equipment:

Steam or diesel road rollers.
Water carts.
Bitumen heaters of 450 gallon capacity.
Premix machines of the Millar's type of 7 and 14 cubic feet capacity.
Bitumen spreaders.

Failure to procure and utilize road building machines, old in point of use in other countries, would seem to be of such vital importance as to permit no further delay in correction. The apparent explanation of cheap labor may well be found a false premise, as labor at current prices is not always cheap in terms of work produced. Transition from manual labor to road machinery should be initiated forthwith. Considerable quantities of road machinery will shortly become available from the Mingaladon Aerodrome construction project. Workshop equipment for the maintenance and repair of such equipment likewise will become available from the same source. The Department now has an organized and capably supervised workshop where certain of its members are trained in the maintenance and repair of road machinery. This existing facility should be expanded by the acquisition of the workshop equipment at Mingaladon, and should be given adequate operating space for establishing a new workshop large enough for the training of substantially increased numbers of men—at least 5 times as many as at present, preferably ten. The utilization of the Mingaladon road machinery should be as immediate as practicable. In the plans for the "King's Highway", a special opportunity exists to combine instruction in the realistic application of road machines to road construction, and instruction in maintenance and repair of road machinery simultaneously with building a desired road. All elements are present and will be available in a short time. This becomes an ideal opportunity to initiate the modernization of construction methods with modern equipment and simultaneously construct a desired modern highway. Such action is recommended and urged.

F. MOTOR VEHICLE REGISTRATION.

1. REGISTRATION FEES. Registration of all privately owned vehicles is required on an annual or semi-annual basis, with a fee for registration accompanied by the payment of a wheel tax simultaneously therewith. The following is a schedule of such fees and taxes.

REGISTRATION FEES AND WHEEL TAX

	Registration Fee in Rs.		*Wheel** Tax in Rs.*	
Type	*Initial*	*Annual Renewal*	*Tax Initial*	*Annual Renewal*
Private cars, including Jeeps	16	12	30	30
Private Vans, 1st ton and below	16	16	100	100
for each additional ton			20	20
Taxis	15	15*	25	25*
Lorries, Privately owned 2 tons and above	32	32	100	100
Each additional ton			20	20
Lorries, for hire:				
One ton or less	30	30*	50	50*
Two tons	30	30*	60	60*
Three tons	30	30*	70	70*
Busses:				
14-16 passenger capacity	30	30	50	50
18-20 passenger capacity	30	30	60	60
24 passenger capacity	30	30	100	100
Motorcycle	4	2	12	12

*Semi-annual renewal. **Wheel taxes vary between Districts.

A grace period of one month is allowed for the renewal of registration after which a fine of Rs. 16 is charged. Registration fees are converted to the general revenue account of the Government agency collecting them, whereas receipts from the wheel tax in city corporations are utilized for the maintenance of streets and in Districts are utilized by the District Councils for the maintenance of District roads.

2. DRIVING LICENSES. There are two types of driving licenses, one issued to owners at a fee of Rs. 10 per year covering the driving of privately owned vehicles, and a second type at a fee of Rs. 12 per year for drivers of vehicles for hire. To obtain a driving license the applicant must be a minimum of 18 years of age, sound in health, possessed of good eyesight and be mentally fit. Practical and theoretical tests are given. Renewal of licenses is required after 12 calendar months with a grace period of one month allowed, beyond which a fine of Rs. 5 is assessed.

3. REGISTERED VEHICLES.

a. The total number of registered automotive vehicles, broken down only as between the Rangoon Town District and the remaining Districts of Burma, are as follows:

AUTOMOTIVE VEHICLE REGISTRATION

	1950		1951	
Type	*Rangoon Town District*	*All Other Districts*	*Rangoon Town District*	*All Other Districts*
Cars and Jeeps	5154	3049	4803	2856
Trucks	2245	6220	2370	5917
Busses	1351	1902	1811	2083
Motorcycles	628	639	468	550
Total	21,188		20,858	

This indicates a decrease in vehicles from 1950 to 1951 by 404 in the Districts, and an increase of 74 in the Rangoon Town District. This is not a significant change in the total number of official registrations and may find explanation in the low number of vehicles imported in relation to the attrition of old vehicles. The majority of vehicles in Burma are pre-WW II or are from Army stocks, surplus at the end of WW II, and are nearing the end of their useful life. The final skill of the Burmese as mechanics receives a compelling testimonial in the sheer fact that many of these old vehicles can be kept running. It is likely that the existence of insurgency has prevented the registration of many vehicles. The probability that there are more vehicles in the Union of Burma than the above tabulation discloses appears to receive support from data published by the United Nations in 1950 giving 32,580 automotive vehicles for the year 1949, and published data showing registration of 18,547 vehicles in 1936-37. It is impracticable to reconcile these conflicting data, but an estimate of an automotive vehicle population of about 25,000 appears reasonable. It is proper to observe that the total number of vehicles is relatively small in relation to the population of Burma and the number of miles of all-weather and fair-weather roads.

b. The Motor Vehicles Department of the Office of the Commissioner of Police, Rangoon, unfortunately affords no breakdown of the location of vehicles registered outside of Rangoon. It is understood that these vehicles are located generally in the principal cities, along the Union Highways and main roads, with the principal concentration being in the Prome-Rangoon-Mandalay area.

4. PROSPECTIVE GROWTH OF MOTOR VEHICLE POPULATION.

a. There is no restriction on the importation of motor vehicles into Burma except from the necessity to procure by application an approved import license. Import licenses are issued by the Ministry of Commerce and Supply, subject to the condition that the importer may not sell the vehicle within a period of two years from the date of his approved import license, which condition is required to be guaranteed by bond, and a second condition that an individual may obtain only one import license in a two year period. Custom duties on vehicles imported from the United Kingdom are 35 per cent of the CIF (costs in freight) and from other countries, 45 per cent.

b. Data showing the number of vehicles imported into Burma were obtainable only for the years 1946-47 and 1947-48:

NUMBER OF AUTOMOTIVE VEHICLES IMPORTED INTO BURMA

Year	*Passenger Cars*	*Busses, Vans and Lorries*	*Motorcycles*
1946-47	1085	252	34
1947-48	568	72	34

It is reported that between one and two thousand applications for the import of vehicles are pending and that administrative procedures are necessarily slow by reason of the work entailed in checking applications for compli-

ance with rules pertaining to prior importation. Data regarding imports for later years would be most useful in estimating prospective growth of vehicle population. However, there are many factors involved, the principal one being the desire of an individual or corporation for a vehicle, accompanied by the ability to pay. Improvement and expansion of the all-weather road net; the expanding economy and increase in business and social activity; the foreign exchange position; regulations of the GUB with respect to importation; and the measure of customs duties all have important effects on encouraging or discouraging actual demand. The number of vehicles actually imported and the number of pending applications appear as the only firm data in this connection. Imports are surprisingly low; pending applications surprisingly high. It would seem clear that the administrative procedure regarding the issuance of import licenses should be scrutinized with a view to adoption of a system permitting prompt approval or disapproval, if delays reported to exist are correct. In any event vehicle population is so small in relation to those factors of the economy of Burma bearing on this subject that it would seem safe to conclude that the registered vehicle population will approximately double by 1959 and that thereafter continued increases are indicated.

G. HIGHWAY TRAFFIC.

1. PASSENGER CARS AND TRUCKS. With less than 21,000 automotive vehicles of all types to use more than 8,000 miles of motorable highways in Burma, there exists the relationship of relatively few vehicles compared with relatively large road mileages. This relationship is so marked that there are not enough vehicles to create a normal traffic problem on the roads of Burma. The density of traffic is extremely low—too low to be considered in terms of density. The impression one gets in driving the roads of Burma is the absence of vehicles, with the ox-carts on the berm roads in the dry season and on the hard surface roads in the rainy season being most numerous. There are very few passenger cars on highways and those are mostly jeeps. Trucks on the highway usually appear overloaded with goods, and not infrequently with fairly large numbers of passengers sitting on top of the goods. Busses designed primarily for personnel are generally fully loaded, but additionally carry light personal baggage, vegetables, small boxes and baggage. Occasional heavy trucks hauling teak logs, bulk oil and other heavy goods are observed. Cities such as Mandalay and Rangoon have problems in traffic congestion, a separate problem not germain to this discussion, apart from noting that these traffic problems must command attention in the near future.

2. ORGANIZED TRUCK TRANSPORTATION.

a. It is reported that there may be a few organized truck transportation companies in Burma. Specific information with respect to them is not obtainable except for the Civil Supplies Transport Union with headquarters in Rangoon, a common carrier for Goods from Rangoon to Mandalay and major cities along the Union highway between these terminal points. This Union also operates trucks north of Mandalay to Katha and certain other principal cities in Upper Burma, but not so far as Bhamo or Myitkyina. This Union accepts passengers only on its goods run to Prome. The Union owns 35 of its own trucks and operates approximately 100 additional trucks which it has on hire. It has ordered 30 new 5 ton Bedford trucks from the United Kingdom.

b. There is no other Union which owns and operates trucks from Rangoon as common carriers. However, many merchants, said to be generally Chinese and Indians, each own a few trucks and operate unscheduled runs to Upper Burma. It is reported that these trucks total somewhere between 500 and 1,000 in number.

c. The Civil Supplies Transport Union hauls goods on rates which are established in the form of an agreement with the Civil Supply Department of the Ministry of Cooperation and Commodities Distribution. Rates are on a tonnage basis and are generally 50 per cent higher than corresponding Burma Railways rates, the two not being directly comparable, however, on the ground that the truck service provides door-to-door delivery. There is a detailed schedule of rates for haulage within the Rangoon city limits, ranging from Rs. 7 to Rs. 10/4 per ton depending upon commodity with waiting time charges additional, varying from Rs. 3/12 per hour to Rs. 2/12 per hour. Three-ton-load carriers may be hired on a daily basis for Rs. 32/8 plus Coolie hire of Rs. 2/8 per day per Coolie. Long distance hauling is scheduled at Rs. 0/7 per ton mile with additional charges for labor as may be required by work performed. Under certain circumstances merchants dealing in large volumes of business receive reduced rates.

d. The Civil Supplies Transport Union has its own workshop in Rangoon which is adequate for the needs of maintenance of its substantial fleet. Repairs as needed can be obtained along the Union highways and main roads where workshops are located in the larger cities.

e. It is reported that the Civil Supplies Transport Union pays tolls to insurgents in order to operate on the highways of Burma. The amount of toll varies according to the value of goods carried, but is said to be in the neighborhood of Rs. 500 for every truck fully loaded; it is also said that there are "no rules" and that the toll is very difficult to predetermine. Tolls are usually paid at given points along the highway. Upon the payment of toll the insurgents furnish a "delivery note" which is adequate to assure safe conduct to destination in the normal case.

3. TRAFFIC LAWS.

a. The traffic laws are found in the "Motor Vehicles Manual" published by the Government of the Union of

Burma in 1939, having been corrected to the 16th November, 1938. In extremely brief summary this manual provides a speed limit of 20 miles for privately owned vehicles and 15 miles per hour for busses, trucks and lorries in towns and cities, with a limit of 30 miles per hour on the open highway. Overtaking another vehicle is permissible with at least 50 yards clear road ahead and after the receipt of a clear signal from the driver of the vehicle being overtaken. Lefthand traffic has the right-of-way except at round-abouts where traffic on the right has the right-of-way. Vehicles traveling on village and District roads must halt before crossing or turning onto main roads. No vehicles may be left unattended on the road lane nor is parking permitted on the roadway proper. Parked vehicles must be on the left side of the road facing the correct direction. Headlights must be turned on half an hour before dusk and until half an hour before dawn. The organization for the enforcement of traffic rules is confined largely to principal cities. There are no highway patrols. Effective enforcement is extremely difficult and is not presently attained. It is evident that the existing motor vehicle code is outmoded. It is recommended that an up-to-date motor vehicle code be prepared, taking into careful account the design and intended capacities of modern automotive vehicles, the problem of the "ox-cart" and the problem created by the combination on a single lane of slow moving with fast moving traffic; and that such new motor vehicle code be promulgated and enforced for the regulation of heavy traffic.

4. SAFETY. There are no traffic accident or safety records available for Burma as a whole. Data for Rangoon follow:

TRAFFIC ANALYSIS FOR 1951 and 1950
FOR RANGOON TOWN DISTRICT

Nature of Offense	1951	1950
Overspeeding	1137	883
Rash and negligent driving		
(a) resulting in injuries	681	667
(b) resulting in death	57	58
Illegal Parking	6218	4569
Disobedience of Traffic Signals or Police orders	2870	2801
Violations by cyclists	62	51
Contributory negligence by pedestrians	33	56
Improper or defective lights, brakes, steering-wheels, number-plates, etc	11,640	10,245
Cases in which M.V. drivers failed to render assistance	28	32
Total	22,726	19,362
Number of persons killed	60	58
Number of persons injured	1,002	867

5. ANALYSIS. The traffic on the streets of Burma's principal cities, particularly Rangoon and Mandalay, is such as to define an incipient traffic problem which should be dealt with at an early date. On the highways there is no congestion nor can there be so long as the vehicle population remains numerically in its present range, nor could doubling vehicle population produce noticeable congestion. There are, however, a number of factors which aggravate the traffic problem on the highway. Of these the most important is combining the ox-cart, carriage and other slow moving vehicles with the modern fast moving motor cars or trucks. Failure of vehicles to remain in their own traffic lane on two lane highways is frequent. Failure to center-stripe two lane highways contributes to incidence of accident and traffic violation. A solution to these problems can only lie in a proper traffic code, properly understood and followed by drivers of vehicles, and properly enforced by the Civil Authorities.

H. PLANNING AND PROGRAMMING.

1. PLANNING AND PROGRAMMING SECTION. The subsidence and final elimination of insurgency will precipitate a volume of highway work larger than any accomplished heretofore. The enhancement and development of the Planning and Programming Section of the Buildings and Roads Department should be undertaken at once with a view to preparing a master plan for original works and major rehabilitation. Such a section need not be large, but it does require a few able and experienced men whose foresight and vision will encompass the problem as it exists. Only by advance planning, covering in detail the near term in harmony with the requirements for the long term, can the needs be balanced. The development of a master plan is regarded as the first important product expected of a proper Planning and Programming Section.

2. ENGINEERING SECTION. Part of the modernization indicated in the Buildings and Roads Department is the enhancement of the Engineering Section so that it can get abreast of modern techniques in surveys, location, design, construction and maintenance, the sum of which is highway engineering. This section should reestablish proper criteria for utilization throughout the Department.

3. BORROW-PIT EXPLORATIONS. Aggregates for road work are now high in cost. Quarry stone is particularly costly by reason of many factors, including transportation charges. River shingle would probably be less expensive and should exist in quality and quantity adequate for road requirements. Exploration to discover major sources of river shingle along each principal route for Union and Main roads should be carried out. Gravel could be crushed for base or surfacing; 30% to 50% crushed particles will be adequate for stability and sharpness. The mouth of each tributary of the Sittang and Irrawaddy Rivers should be examined, suitable gravel sought by excavating test pits or by bulldozer, and available quantities estimated. Typical samples should be taken for screen analysis, hardness, soundness, density and stripping tests. Tests other than screen analysis should be performed in a central soils laboratory. This action is recommended and urged.

4. ASPHALT STORAGE. In the major work program which lies ahead, as much as 10,000 to 15,000 tons

of asphalt may be required each year. This can be purchased and handled most economically if a bulk storage plant is installed, probably for tanker delivery at Rangoon. A small tanker load (70,000 bbls, capacity) would possibly supply all needs for one year's construction. As bulk asphalt costs about $20.00 per ton vs. $80.00 or more for drummed asphalt, the cost of a storage plant can easily be absorbed with a considerable margin. It is recommended that this proposition be investigated and given thorough consideration, with a view to adoption.

5. CONTRACT WORK. The volume of work to be accomplished is so great that it may be deemed wise to award separable major portions of the work, particularly of original works, to foreign contractors. Should this be done, it is urged that the contract terms emphasize the requirements for the use of Burmese engineers, supervisors, technicians, mechanics, and other skilled and semi-skilled personnel on a work basis to include training. A small percentage at the beginning of the contract could be increased until the bulk of the professional work would be carried by Burmese toward the end of the contract. This would permit excellent on-the-job training. The principle is recommended.

6. LABORATORY. A modern materials testing laboratory should be established, capable of testing all types of locally produced materials to determine suitability for utilization in highway construction and maintenance. Soils equipment should be included for the main laboratory as well as equipment for mobile field soils testing laboratories. Such a laboratory is essential for economy in improved methods of construction.

7. THE OX-CART PROBLEM. There are undoubtedly a million bullock or ox-carts in use in the Union of Burma. The majority are rural in origin, crudely constructed, and unsprung; the wheels are generally provided with steel tires which protect the wheel but damage the road. The current vehicle code denies hard-surface roads to ox-carts in the dry season but permits such use in the rainy season. This is only a partial answer to the problem. Berm roads are also a partial answer. Some Southeast Asian countries require pneumatic tires on ox-carts as prerequisite to use on hard-surfaced roads; this may be an answer. Investigations in other countries, particularly India, should provide guidance. The ox-cart problem is of such moment that a thorough and realistic investigation and experimental program is indicated to develop the optimum solution and such is recommended.

8. THE "KINGS HIGHWAY". The "Kings Highway" is a proposed four-lane divided express-way from Lake Victoria, Rangoon, to the Mingaladon Airport. The plan is boldly conceived and will be costly in view of the four-lane paving and wide right-of-way. The location is feasible, being midway between existing north-south roads. It is possible that a location on better ground could be obtained eastward of that now planned, provided one or two very gentle curves could be introduced in the alignment. The plan is estimated to cost Rs. 8,300,000, plus right-of-way consisting of about 100 acres. Substantial reduction in cost might be effected as follows:

		Total Cost
1.	Defer paving one track	Rs. 71,00,000
2.	Defer construction one track	57,00,000
3.	Item 2 and 50% reduction in gravel cost	51,00,000

In order to further reduce the cost, asphalt paving is recommended in lieu of concrete paving.

1.	Total cost with concrete	Rs. 83,00,000
2.	Total cost with asphalt	57,00,000
3.	Asphalt, defer paving one track	50,00,000
4.	Asphalt, defer construction one track	41,00,000
5.	Item 4 and 50% reduction in gravel cost	36,00,000

The need for modernization of construction methods and training Departmental personnel in the use, maintenance and repair of road machinery has been previously discussed. The idea of combining training with the actual construction of the "Kings Highway" appears as a fortuitous opportunity to modernize, to train and to build simultaneously. On this basis it is recommended that the "Kings Highway" be constructed on the best available ground between the two existing north-south highways, using asphalt paving. Construction of one track should be deferred until priority work elsewhere in Burma has been accomplished.

9. TRAFFIC COUNTS. Use of roads by vehicular traffic is the purpose for which they are constructed. Records of use become vital statistics. With them, intelligent future planning can be done. Without them, guesswork must be substituted where facts are needed. "Traffic counts" detail the use to which highways are put and should be established on a basis more realistic than the 5-year-scheme now in force. It is therefore recommended that an adequate system of highway counts be designated and implemented and that accurate statistical data be compiled therefrom and used in planning.

10. TRAINING OF PERSONNEL. The Buildings and Roads Department is short in terms of technically trained experienced and qualified men. This runs to nearly all categories from semi-skilled and skilled up to and including Executive Engineers. For example, some Divisions are headed by Executive Engineers who do not have the benefit of formal education in Engineering. The comments and constructive suggestions contained in Section II are applicable with full force to the problem of the Department. Without great improvement in the number and quality of trained leaders, the program which must be carried out will indeed be hampered.

11. REHABILITATION OF EXISTING ROADS. Rehabilitation to pre-World War II condition, plus nominal improvements, of the Union highways and main roads is clearly the top priority obligation of the Department. This, of course, includes the existing main roads leading into and lying within the frontier areas.

12. CONCRETE VS. ASPHALTIC PAVING.

a. In order to determine the type of paving most economical for the reconstruction program a study has been made of recent cost figures supplied by the Buildings and Roads Department. A typical major improvement now budgeted and under construction is the Prome-Taungup road. All weather construction recommended by the Supervising Engineer, Maritime Circle, is estimated as follows:

1.	Boulders for 12 ft. wide soling 6" thick.....Rs.	8,65,800
2.	Laying, soling and rolling.....	1,44,300
3.	Soft metalling, 10 ft. wide, 4½" thick.....	9,28,000
4.	Light rolling, soft metalling.....	69,600
5.	Crusher run hard metal from Kyautaga and Taungup 10 ft. wide, 12" thick.....	7,09,500
6.	Spreading and consolidation of hard metal....	76,500
7.	Pea gravel	3,09,000
8.	Sand seal coat	2,25,280
9.	Bitumen	8,41,000
	Total cost 58 miles.....	41,68,980
	Cost per mile (10 ft. wide).....	72,000
	Cost per mile (20 ft. wide).....	1,44,000

b. The above cost for asphalt paving and base provides rock soling, 6" thick by 12 feet in width, soft metalling, 4½" thick by 10 feet wide, hard metalling, 1½" thick by 10 feet wide and sealing ½" thick. To equal this construction in concrete a slab 8" thick by 10 feet wide would be required or 1,300 c.y. per mile. For 20 feet roadway the quantity would be 2,600 c.y. per mile. The cost per c.y. is estimated as follows based on the Mingaladon Airport paving costs:

	Paving Width	
	10 *ft.*	20 *ft.*
Cement .....Rs.	42.2	42.2
Sand	3.8	3.8
Gravel	42.3	42.3
Plant Depreciation	40.0	31.0
Operation & Maintenance.....	34.0	27.0
Mixing and Placing.....	29.0	23.0
Overhead and Profit.....	35.0	30.0
Unit Cost per cu. yd. — Rs.	226.3	199.3

c. The cost per mile for 10 ft. wide paving would be 1,300 c.y. @ 226.3 = Rs. 295,000 and for 20 ft. width 2,600 c.y. @ 199.3 = Rs. 518,000.

d. The analysis indicates that concrete would cost about 4 times as much as asphalt paving in the 10 foot width and over 3 times as much as in the 20 foot width. The above unit costs are roughly in agreement with similar work in the United States on major contracts, where road machinery is used. In recent years it has been found that concrete paving is normally too costly for the state and federal highway paving program. Accordingly it is not used where considerations of economy govern the choice.

e. In regard to maintenance, there is little difference between concrete and asphalt. The latter has an excellent service record if a dense graded plant mix is placed on a well drained base of compacted gravel or crushed stone. Accordingly, it is recommended that asphalt paving be utilized in lieu of concrete for the current program.

f. The Mingaladon concrete plant is well adapted to production of mass concrete for a gravity dam. It should be considered for the Mon River or other hydro-electric project where a large quantity of concrete will be placed.

13. IMMEDIATE AND NEAR FUTURE PROJECTS. The planning of the original works, rehabilitation and maintenance program for the immediate and near future is a task requiring great, if not full knowledge, of all matters pertaining to the highway and road system of Burma and the Union of Burma. This must be developed with sound judgment and thorough-going care by the Planning Section of the Buildings and Roads Department. An estimate has been prepared, however, based on the best information available which is believed to be a reasonable selection of items for the immediate and near term. These follow in Tables II and III, together with estimates of cost for the work.

TABLE II
IMMEDIATE PROJECTS

Item	*Estimated Cost in Rupees*
Rehabilitation of existing Union highways and main roads, including major improvements and construction of limited mileages of two-lane highways near Rangoon and Mandalay and other large cities.....	1,96,76,000
Waw-Sittang, all weather road.....	13,26,000
Zigon-Indar, road improvement.....	1,62,000
Thongwa-Kazan, jeepable road.....	1,75,000
Penwegon-Ananbaw, road improvement.....	10,20,000
Madauk-Shwegyin, new road	1,90,000
Nattangwin-Kyaukkyi, road improvement.....	8,55,000
Thanatpin-Kayan, jeepable road.....	3,42,000
Prome-Taungup, road improvement.....	20,00,000
Pegu River Bridge	7,17,000
Pazundaung River Bridge.....	14,20,000
Daga River Bridge.....	2,33,000
"King's Highway" as training project.....	54,00,000
Re-location and re-establishment of workshop using equipment from Mingaladon.....	10,00,000
Laboratory, including borrow-pit investigations.....	5,00,000
New Motor Vehicle Code, and studies relating to revenue for highway and road construction and maintenance....	4,62,000
Total	3,54,86,000

TABLE III
NEAR FUTURE PROJECTS

Item	*Estimated Cost in Rupees*
Completion of the rehabilitation of existing Union highways and main roads, including major improvements and construction of limited mileages of two-lane highways near Rangoon, Mandalay and other large ciites.	7,51,00,000
Kalewa-Ye-U, improvement	40,00,000
Prome-Taungup road completion.....	70,00,000
Thanbyuzayat-Ye improvement	35,00,000
Pyinmana-Loikaw improvement	40,00,000
Access roads to timber extraction areas.....	35,00,000
Surveys and borrow-pit investigations.....	15,00,000
Laboratory	10,00,000
Extension of main road net to and within frontier areas, aid and grants to districts and autonomous states for local roads, and additional two-lane highways.....	4,94,00,000
Total	14,90,00,000

I. CONCLUSIONS AND RECOMMENDATIONS.

1. RESUME. The Buildings and Roads Department is the principal subdivision of the Ministry of Public Works, Rehabilitation and Labor. As a Government department, it operates on the basis of definite project submission, budget estimates and a definite procedure for the development with respect to each project of technical sanction, administrative sanction and financial sanction. It operates from funds made available to it from annual appropriations. The Department is responsible for the Union highways and Main roads. Districts are responsible for District and local roads and Autonomous States are responsible for all roads in their areas other than certain notified main roads.

The existing highways system consists of about 6,000 miles of Union highways and Main roads and 3,000 miles of District and local roads. The many miles of ox-cart and mule paths feed into the main and District roads and are an important part of the total system. Most roads date from pre-World War II and have suffered from excessive use and deficient maintenance generally since 1941. Insurgency currently limits the locations where original works and maintenance may be done and creates considerable loss by destruction of bridges.

There are now about 21,000 vehicles registered in Burma, with approximately 45% in Rangoon. Most of these vehicles are old, dating from pre-World War II or from army stock. It is probable that there are considerable numbers of unregistered vehicles which may raise the actual total to approximately 25,000. Organized passenger or goods bus or truck companies are very limited in number and scope, only one being specifically identified. Many merchants operate single or small groups of vehicles on over-the-road traffic on a door-to-door basis. Total tons carried by truck on highways is reported to be as great as the total carried by the Burma railways. Even so, the very small number of busses and trucks in relation to the total length of roads is such as to create no traffic congestion. Bus and truck traffic on highways is not effectively regulated. Busses and trucks are habitually overloaded. With the improvement in the highway net and with the increase of vehicles proposed, it is certain that highway traffic will increase many fold. The subsidence of insurgency and the expansion of the economy of Burma will give added impetus to increase in traffic.

2. RECOMMENDATIONS. It is recommended:

a. That major rehabilitation and maintenance of existing National Trunk and Main roads be undertaken as top priority as rapidly as security will permit.

b. That the Buildings and Roads Department organize a thoroughly adequate Planning and Programming Section for long-range planning; and that the Engineering Section be expanded for the continuing development of criteria and standards for highway design, construction and maintenance, including detailed surveys, foundation and borrow pit investigations, laboratory analysis, and aerial mapping.

c. That the work of Buildings and Roads Department be modernized by the:

(1) Application of modern machines to highway construction, rehabilitation and maintenance.

(2) Expansion to broaden greatly the scope of formal and on-the-job training of technical and semi-technical personnel in construction methods, use and maintenance of modern machines, utilization of local materials ,etc.

(3) Establishment of a modern laboratory for testing suitability of local materials, soils stabilization, etc., including the establishment of branch field laboratories as required.

d. That the Buildings and Roads Department develop a master plan to include a comprehensive program of highway planning and programming.

e. That a long range study be made to determine the optimum basis of financial assistance by the GUB to Districts and Autonomous States in the building of local roads.

f. That the Buildings and Roads Department initiate and execute the studies and tests necessary to develop a specific solution for the "ox-cart problem".

g. That the shop equipment now in use at the Mingaladon Airport Construction project be procured and moved to a suitable location to serve the Buildings and Roads Department, and that it be used as a training facility for mechanics and as a shop for the maintenance and overhaul of equipment.

h. That the Buildings and Roads Department modernize and extend their system of making "traffic counts", increasing the frequency thereof, especially on national and main roads, and preserving these data in positive form for constructive use in planning.

i. That the "King's Highway" from Lake Victoria to the Mingaladon Airport be constructed, initially as a one track, two-lane highway of asphalt paving, utilizing this project as a thoroughly organized training program for engineers, supervisors, operators and mechanics in modern construction methods and techniques, and in the use, operation and maintenance of modern road construction machinery.

j. That additional two-lane paving of portions of Routes 1 and 2 and certain all weather construction of portions of Routes 3, 4 and 7, and a new road from Pyinmana to Loikaw be approved and construction undertaken. (Route numbers are shown on map at the end of this Section.)

k. That a new motor vehicle code be prepared, promulgated, and enforced for the regulation of highway traffic, including control of ox-carts on main roads.

TABLE I
CONDITION OF NATIONAL AND MAIN ROADS, 1948

Section	*Miles*	*Deficiencies in Road*
Route No. 1		
Rangoon-Nyaunglebin	98	Flooding Mi. 40— 92
Nyaunglebin-Pyinmana	146	Flooding Mi. 130—180
Pyinmana-Meiktila	94	Flooding Mi. 271—272 to 413—338
Meiktila-Mandalay	92	Myitnge Bridge Temp. "Bailey"
Mandalay-Maymyo	42	22 hairpin bends
Maymyo-Hsipaw	87	(Bends very sharp in Gokteik Gorge, Mi. 80-93 above Mandalay—Gravelled after Mi. 88-corrugated and bumpy)
Hsipaw-Lashio	46	
Lashio-Namkhan	129	Asphalt 54 mi., Gravel 75 mi.
Namkhan-Bhamo	67	Flooding for 20 miles
Bhamo-Myitkyina	116	Two major ferry crossings — Fair weather route 80 mi.
Total Route 1	917	(260 mi. substandard)
Branches		
Zayatkwin-Rangoon	31	Not in use—dusty surface, bridge out
Pegu-Thanatpin	7	Metalled
Toungoo-Thandaung	28	"Good surface"
Meiktila-Myingyan	40	Thin Don Chaung, impassable after heavy rains
Meiktila-Kyaukpadaung	54	Very rough—nine unbridged Chaungs
Total Branches	160	(54 miles substandard)
Route No. 2		
Htaukkyan-Prome	158	
Prome-Satthwa	91	Mi. 83 from Prome; unbridged Chaung impassable after rains
Satthwa-Taungdwingyi	10	Mi. 91 to 101 scheduled for remetal and asphalt in 1948
Taungdwingyi-Magwe	51	Mi. 22 to 31 from Taungdwingyi scheduled for asphalt in 1948
Magwe-Yenangyaung	32	Mi. 14 from Magwe; unbridged Chaung impassable after rains
Yenangyaung-Kyaukpadaung	34	Mi. 5 from Yenangyaung; unbridged Chaung impassable in flood
Kyaukpadaung-Myingyan	59	Several unbridged Chaungs rough, potholed — metalled
Myingyan-Yewun	57	Very bad condition—asphalted
Total Route 2	492	(135 mi. substandard)
Branches		
Thayetmyo-Mindon	30	
Route (2)-Meegyaungye	11	
Gwegyo-Chauk	17	
Kyaukse-Amarapura	20	
Onhmin-Myotha	10	
Total Branches	88	(No deficiency noted.)
Route No. 3		
Payagyi-Waw-Sittang	27	Metalled 11 mi. Fair weather 16 mi.
Sittang R.-Kyaikto	17	Railroad Ferry at Sittang Laterite all weather.
Kyaikto-Martaban	80	19 mi. metalled & asphalt remainder mostly metalled only.
Martaban-Moulmein	3	Ferry (I.F. Co.)
Moulmein-Thanbyuzayat	40	Good asphalt road
Thanbyuzayat-Ye	57	Surfaced 10 foot width—Bridges crudely constructed
Ye-Tavoy	100	Fairly good—all weather
Tavoy-Mergui	155	Metal or gravel surface. Seven ferries—bad approaches
Total Route 3	479	(230 mi. substandard)
Branches		
Bilin Bridge-Papun	76	Fair weather—good condition except 25 miles
Bilin-Taungzun	8	Laterite all weather with bridges in bad repair
Thaton-Hlaingbwe	48	Metalled or laterite 24 mi., ferry at Salween R.
Thanbyuzayat-Amherst	15	
Tavoy-Maungmagan	10	Second class
Tavoy-Myitta	35	Asphalted to Mi. 31
Myitta-Wazunchaung	14	Metalled
Total Branches	206	(84 mi. substandard)
Route No. 4		
Mandalay-Sagaing	13	Ava Bridge demolished — I.F. Co. operates ferry
Sagaing-Shwebo	58	15 mi. excellent—14 mi. fair—29 mi. bad corrugated surface
Shwebo-Ye U	28	9 mi. tarred—dry weather bridge-Mu River — ferry in floods
Ye U-Kalewa	104	Fair weather only—station wagon can make trip—great care needed
Kalewa-Tamu	100	Metalled road in disrepair — 10 mph speed advisable
Total Route 4	303	(250 mi. substandard)
Branches		
Ohndaw-Monywa	67	Dry weather only—ferry at Mu River
Shwebo-Kyaukmyaung	17	Good road—dangerous, narrow bridges Mi. 14 & 16
Shwebo-Kawlin	98	Bad condition both road and bridges
Ye U-Monywa	68	11 mi. tarred—rest fair road in dry weather
Kalemyo-Pauk	150	Fair weather
Minbya-Kyauktaw	50	
Pakokku-Myaing	60	Fair weather
Total Branches	510	(430 mi. substandard)
Route No. 5		
Meiktila-Taunggyi	118	Metalled or asphalted
Taunggyi-Loilem	57	All weather
Loilem-Takaw	111	Metalled or graveled—landslides during rain
Takaw-Kengtung	114	Metalled or graveled—landslides during rain
Kengtung-Tahkilek	105	Narrow, hazardous
Total Route 5	505	(300 mi. substandard).
Route No. 6		
Mudon-Myawaddy	104	Partly metalled—ferry service at Chaungnakwa
Total Route 6	104	(50 mi. substandard)
Branch		
Metharaw-Kya In	12	
Total Branches	12	No deficiency noted
Route No. 7		
Prome-Taungup	110	Rough, dry weather road
Total Route 7	110	(110 mi. substandard)
Branches		
Sandoway-Gwa	80	30 mi. fair weather
Kyaunggon-Irrawaddy R.	80	
Kyaunggon-Henzada	50	
Henzada-Myanaung	70	Fair weather
Total Branches	290	(140 mi. substandard)
Route No. 8		
Minbu-An	90	Trail
An-Minbya	100	Trail
Minbya-Kyaunktaw	50	Trail
Total Route 8	240	(240 mi. trail)
Branches		
Minbu-Sidoktaya	90	Fair weather
Salin-Saw	70	Fair weather
Akyab-Rathedaung	40	20 mi. fair weather
Maungdaw-Buthedaung	30	Fair weather
Total Branches	230	(210 mi. substandard)

The mileage of Numbered Routes totals 3,150, of which 1,575 miles are substandard or trails. The Branch roads shown on the map total 1,500 miles with 900 miles substandard.

Section VIII d

AIRWAYS

A. ORGANIZATION.

1. The airways of Burma are a Government monopoly. This monopoly is exercised and controlled through the media of the Office of the Director of Civil Aviation for certain functions as later discussed, and the Union of Burma Airways Board, which establishes policies for and supervises the operation of the Union of Burma Airline (UBA) in Burma. The office of the Director of Civil Aviation has existed since well before World War II. The Union of Burma Airways Board was originally constituted under the Nationalization of Air Transport Order of 23 March, 1948, but derives its present organization pattern and authority from the Union of Burma Airways Order of 29 March, 1950.

2. The Office of the Director of Civil Aviation (DCA) is a technical and adiministrative office, disassociated with the actual operation of any airline. The DCA is responsible for the establishment and maintenance of Civil Airports; the operation of airports; the establishment of technical criteria for the loading, maintenance and operation of non-military aircraft in and over Burma; the licensing of aircraft, pilots and airplane mechanics; operation of the communications system for aircraft control and signals; and the investigation of all non-military aircraft accidents. The DCA is a member of the Union of Burma Airways Board.

3. The Union of Burma Airways Board is now organized in accordance with the Union of Burma Airways Order of 1950. The Board is headed by a chairman who is also the Chief Executive Officer of the Union of Burma Airways. The Board is responsible primarily for the task of organizing and establishing air-transport services within the Union of Burma:

a. to provide rapid communications within Burma, and externally to adjacent countries,
b. to speed up the carriage of mails, essential supplies and urgent freight,
c. to foster air-mindedness, and
d. to develop a national air-transport organization for both internal and external operations.

In this task the Board is held responsible to the Government of the Union of Burma (GUB) under the Ministry of Transport and Communications. The Order gives it a monopoly over commerical airline operations within Burma. To effect better coordination with those Ministries and Agencies most concerned with its operations, the Director of Civil Aviation and the Secretaries from the Ministries for Transport and Communications and Finance and Revenue are included as Board members. The Order gives the Board very wide powers in that it imposes no restrictions on the formulation of operational policies for furtherance of adequate air transport services. However, on the administrative side, the Board is subject to control by the GUB in its appointments of executives and advisors, as well as in its financial operations which are audited by the Auditor General of the GUB. Revenues from operations go into "The Union of Burma Airways Board Fund," which the Board administers directly in support of its operations and functions. It accordingly has adequate flexibility in the conduct of business.

4. To implement the general scheme as laid out in the Burma Airways Order of 1948, the GUB advanced the Board a loan of Rs. 50 lakhs at 3% interest to enable it to organize and establish operations, purchase equipment, and establish and maintain an executive office. The Board has not found further funding operations necessary and has liquidated, as of December, 1950, the original advance by refunding the Rs. 50 lakhs, having paid interest thereon for two years. Its operations have produced an operating profit from the beginning, and currently continue to do so.

5. It was envisaged in the Nationalization of Air Transport Order of 1948 that the Board should be responsible

primarily for establishing an "Air Transport Company" in due course, and until such a company was duly constituted and registered, the Board would perform and exercise the duties and functions specified in that Order. The Order of 1948 was superseded by the Union of Burma Airways Order, 1950. Under the latter Order the Board is responsible for the establishment of Air Transport Services in the Union of Burma, and the idea of the formation of an Air Transport Company has been abandoned. The Board began operations in September, 1948, with a fleet of six new de Havilland Doves. Burma was not air-minded at that time. The 6 Dovês constituted a deliberate, modest beginning in equipping a passenger carrying airline. But the dislocation of surface transport almost immediately forced operations to expand. Expansion in its first phase was accomplished by chartering aircraft from foreign airlines, some few planes for passengers, but larger numbers to satisfy the need for freight movements in large tonnages. This operation was profitable. In the latter part of 1949 it was concluded to be good business for UBA to buy its own planes to accommodate a substantial part of this increased volume. Accordingly, an order was placed for the purchase of seven Douglas Dakotas, which was subsequently increased to a total of nine. Initial efforts to procure planes were not successful, and it was in the early part of 1950 that the first of the purchased planes arrived, with the last plane of the order reaching Burma in June, 1950. Charter operations then diminished. Simultaneously, surface transport improved, and very soon thereafter the charter Airplanes were released since the business volume could then be carried in UBA aircraft.

6. The earliest organization of UBA was quite simple with the Board at the top, a General Manager, an Assistant, and the Chief Engineer, with a few pilots. A reorganization of the Union of Burma Airways was effected in April, 1950, designed to cope with the full responsibilities of providing air transport, and intended to bring about drastic improvement in administration and service. This organization pattern continues to date, and is illustrated in the chart at the end of this section. The Board remains at the top, with its Chairman employed on a full-time basis as the Chief Executive Officer of UBA; he is responsible, subject to the Board, for all plans, policies and procedures relating to the efficient management of the organization. He is assisted by a General Manager who has direct responsibility for administration and accounts, and supervisory responsibility for the Commercial Manager, the Technical Manager and their staffs and functions.

B. EXISTING PLANT AND FACILITIES.

1. The existing physical plant and facilities are generally adequate for current requirements within Burma, although certain improvements are clearly desirable. There are at present 28 airfields in addition to the main airport at Mingaladon on the Civil Aviation Registry. These are of various lengths ranging from 3000′ to 6000′. The surfaces also vary as shown below. Some of the rolled earth landing strips are serviceable only in the fair weather seasons between October and May. The summary table below indicates the numbers under various types:

SURFACE	PSP	Metaled Surface	Tarmac	Gravel or Laterite	Rolled Earth	Total
	3	2	7	14	3	29
LENGTH	6000′ 4	Between 6000′-5000′ (x150) 4	Between 5000′-4000′ 12	Between 4000′-3000′ 9		29
SUITABILITY	80,000 lbs. or above 2		60,000 lbs. 2	30,000 lbs. 20	Below 30,000 above 25,000 5	29

2. Of the 29 there are 11 airfields with night-lighting facilities for emergency use, and with radio control, namely Akyab, Bassein, Heho, Lashio, Magwe, Mandalay, Mergui, Moulmein, Myitkyina, Rangoon and Tavoy. The night-lighting facilities consist of goose-neck flares for emergency landing only. The radio control is both the Radio Telephone for internal services and VHF/D/F (Very High Frequency) for approach, landing, parking, and general instructions and clearance.

3. The Mingaladon Airport is being rebuilt to standards and specifications matching those of the International Civil Aviation Organization. On 5 January, 1952, the "north end" of the new runway was opened for commercial use. This portion of the new runway is 5300′ long by 200′ wide. The runway under construction is being built to 8100′ length, with taxi-tracks and large apron, and is scheduled to be completed prior to 30 June, 1952. A modern terminal for passengers and freight is planned for early construction. A thoroughly modern control tower, with all facilities, has been constructed and will be placed in use in the near future. By June, 1952, the Mingaladon Airport will be ready to accept literally any aircraft engaged in international business.

4. In addition to the 29 airfields listed in the Civil Aviation Registry, there are others which are owned by autonomous states of the Union of Burma, by private interests, or by the GUB itself. Some are used by the UBA regularly or in fair weather only. A map showing location of airfields listed in the Civil Aviation Registry is attached at the end of this section and data pertinent thereto are shown on Table I. These data show that there is much new work to be done to bring many of the airports up to a thoroughly satisfactory standard. The standard finally to be obtained should be as established by the GUB. In establishing such standards for airports in Burma, the practices in construction followed by other countries in the interests of safety may serve as a useful

guide. The specifications prescribed by the International Civil Aviation Organization would likewise be useful as a guide. Clear and smooth areas on each side of the paved landing strip, and clear approach zones to the ends of the landing strip would seem to be essential. Facilities for night-lighting and radio control are standard equipment in commercial airports, again in the interest of safety. Thoroughly adequate drainage and perimeter fencing are both important. In future years, when the Dakotas and Doves are superseded by more modern aircraft, it is a practical certainty that improved airports will be required for their accommodation. From a long-range viewpoint, as contrasted with immediate needs, there is clearly a total quantity of engineering work to be done on registered airports that outruns the possibility of immediate accomplishment. The work should therefore be planned on a long range basis, in terms of a definite "Master Plan", and an annual increment accomplished consistent with the priorities developed in such plan and the availability of funds. The established needs of the UBA as evidenced by their traffic records identifying business sources; the operational needs of the UBA from the standpoint of airport distribution to provide places to get down in bad weather; the need to serve certain areas which otherwise would be relatively isolated; and in certain cases political considerations and possible Burma Air Force needs, have a bearing on the distribution and priority of work in the preparation of an adequate Master Plan.

5. The flying equipment of the UBA includes six de Havilland Doves, twin engined craft carrying an all-up lift of 8,500 pounds, and nine DC-3 Dakotas, twin engined craft with an all-up lift of 28,000 pounds at sea level. The former will accommodate a maximum of 11 passengers, the latter 28. Actual passenger lift on a given flight is varied with the amount of baggage and freight lifted. The Dove aircraft were purchased new, and the Dakotas in excellent but not new condition. The long record of efficient and safe performance of the Dove and Dakota aircraft types is well established. These types are well suited to the service needs of the UBA. Regardless of these considerations, and the excellent condition and maintenance of these aircraft now owned by the UBA, replacement will necessarily become desirable in due course. When replacement is accomplished, it should be on a phased program, accepting only those new or modern types which have been proven in full scale, commercial operation, avoiding any craft however modern not clearly graduated from its experimental stage. It is possible that a beginning should be made now by the introduction of one, or at most two, modern aircraft into the UBA operation. Consideration should be given to buying a separate type plane especially designed as a freight carrier as a part of the planned, phased aircraft replacement; such action would enhance the service rendered to passengers. Replacement of any type aircraft will be expensive and on a market very apt to be a "seller's market". Financial provision must be made well in advance for these reasons for the replacement of aircraft at the time it becomes necessary.

6. *a.* The adequate maintenance of aircraft is one of the most important functions in the operation of a commercial airline. Criteria and standards of maintenance for aircraft are prescribed by the DCA; the initial patterns adopted for such standards are based on those of the Royal Air Force and Ministry of Civil Air, United Kingdom. As rapidly as the manufacturers of the Dove and Dakota airplanes publish additional technical instructions with respect to their planes, the DCA incorporates pertinent parts into the established requirements. There is an over-all steady increase in the actual standards of maintenance set by the DCA.

b. The UBA has organized its maintenance quite effectively, with a Manager, (technical) in charge thereof. The workshop is located at Mingaladon; although at least two airports in other cities have hangars, no other workshops are organized or presently required. The workshop is well managed, is obviously clean and arranged in an orderly fashion, and apparently is operated with the meticulous strictness that aviation maintenance demands. The workshop is departmentalized in typical pattern, with an engine overhaul and test section, propeller overhaul section, airframe section and the necessary back-up sections such as main stores, electrical, welding, etc. Installed equipment is adequate for the complete overhaul of the Dove airplane, and the complete overhaul of the Dakota except for engines and propellers. Airframe overhaul, when not done locally, is contracted to the Hindustar Aircraft Company, Bangalore, India, or to the Hongkong Aircraft Engineering Company. Engines are normally sent to the Field Aircraft Services, Croydon, England, for overhaul, but sometimes to the Hindustan Aircraft Company or the Hongkong Aircraft Engineering Company. Propellers are normally sent to Field Aircraft Services and the Hongkong Aircraft Engineering Company for overhaul. Time in transit and at factory for aircraft or engines becomes important to UBA, the procedure now followed necessitates the ownership of approximately 40 engines on hand other than those installed in aircraft, in spite of the sound business arrangement with Field Aircraft Services under which they dispatch by ocean freight an overhauled engine upon receipt of documentation showing an engine has been dispatched from Burma to them for overhaul.

c. The supply of spare parts, and the facility with which replenishment of spare parts may be accomplished, are equally important with the character of the workshop itself. Here UBA is confronted with an extremely difficult problem, one which is solved only in part. The spare parts on hand are usually deficient in some particular; the flow of spare parts is habitually slow. It is impossible to procure spare parts from India, the closest market, as

the Government of India will not issue export licenses. Parts for engines, propellers and airframes are obtained from Field Aircraft Services and the de Havilland Associated Companies, England, and from Aviquipo Inc., from New York City, Australia and Hongkong. Slowness in parts procurement springs partly from the tight world market conditions, and partly from limitations in foreign exchange, particularly dollars.

d. The excellence of the safety record of UBA is valid evidence that maintenance of aircraft is well organized and executed, in spite of difficulties. It would appear desirable that the GUB or UBA should establish and maintain a workshop for the complete overhaul of all Burmese aircraft as a self-contained unit, abandoning dependence upon foreign companies for this critical service. It would save time and money now involved in tying-up equipment in ocean freight. It would tend to expedite and give greater flexibility in maintenance work. It would provide added employment at home. It would make for self-sufficiency, of distinct value in itself. Even though spare parts would still have to be procured from overseas, higher stockages which could be supported by higher volume would tend to make shortages less frequent or critical. The essential element for the support of such a workshop is increased work volume, which may possibly be secured from the Burma Air Force (BAF), privately owned planes in Burma, or by attracting business from foreign countries. Such a workshop could be operated by the UBA; a Ministry for Air as recommended by Group Captain P. Holroyd-Smith, then DCA, approximately a year ago; or by a separate organization created by the GUB as a new industry. It is believed that the cost of additional equipment necessary for this purpose, and the increased capital investment in spare parts, would not exceed Rs. ten lakhs, if organized under the sponsorship of the UBA; for development from an independent start, the estimated cost is Rs. fifty lakhs. The expansion of the existing workshop facility for the complete overhaul of standard aircraft used by UBA and all other Burmese aircraft as a self-contained operation is recommended for detailed investigation and careful consideration.

C. PERSONNEL

1. Since the inception of the UBA in 1948, air crews have been composed of non-nationals as pilots and co-pilots, mainly of British and Commonwealth origin, but other cadres such as radio operators and hostesses are recruited from locally trained personnel. Employment figures are as follows:

		Pilots	*Others*	*Total*
1948/49	Non-national	7	1	8
	National	—	4	4
1950	Non-national	20	—	20
	National	2	12	14
1951	Non-national	15	—	15
	National	3	14	17

These figures are only representative; actual figures vary slightly from month to month.

2. Ground crews fall under two categories, those handling passenger and freight services, and those whose duties are mainly of indoor nature in bookings, freight acceptance, etc. Both these categories are filled by Nationals only. The original ground crews who were recruited from the ex-employees of other airlines have accepted the task of training recruits, who in turn have helped train the late-comers, thus creating a successive method of continuous training which the team-shift method of work has made possible. A typical cadre for bookings consists of the following:

a. Traffic Superintendent ..... Airport
b. Chief Traffic Officer ..... Office
c. Traffic Officers ..... Team Leaders
d. Traffic Assts. Sr. Grade
e. Traffic Assts. Jr. Grade } Composites of teams
f. Traffic Clerks

Services are handled by teams working in rotation of three shifts of 6 hours duration with each team headed by a Traffic Officer. For the two out-stations where branches of UBA have been established, a miniature handling team composed of one Traffic Officer and one to two Traffic Assistants is maintained in charge of bookings and service. For the remaining 28 out-stations within Burma, commission agents are retained to perform these services. More branches are being established as fast as business warrants. The total employment figures of ground crews are as follows:

1948/49	53
1950	71
1951	80

In addition there are temporary workers, mainly porters employed on a daily wage basis; the current number employed daily is about 50.

3. The Maintenance Crew represents the largest segment of employment, actually about three-fifths of the total employees of the UBA. The cadres maintained are as below:

Manager (Technical)
Senior Lines Maintenance Engineer (SLME)
Lines Maintenance Engineer (LME)
Senior Supervisors (SS)
Supervisors (S)
Junior Supervisors (JS)
Mechanics—Grade I, II, III
Apprentices and Trainees
Misc.: Storemen, Clerks, etc.

The comparative employment figures for the three years of operation are as follows:

1948/49	60
1950	80* to 230**
1951	300

*1st half '50 **2nd half '50

There was a sudden increase in the employment in the latter half of 1950, resulting from the acquisition of 7 Dakota aircraft as additions to its operating fleet of six de Havilland Doves. In 1951 two further Dakota Aircraft (De Luxe) were acquired, and the average monthly employment figure for Maintenance Crew rose to over 300. The present number is around 300 and the distribution of nationals and non-nationals under the various cadres is as follows:

	MGR	*SLME*	*LME*	*SS*	*S*	*JS*	*Mech.*	*App.*	*Misc.*	*Total*
National	1	—	—	1	1	7	60	37	127	234
Non-national	—	1	6	2	5	1	13	—	3	51
	1	1	6	3	6	8	73	37	130	285

The present combined role of Manager (Technical) and Chief Engineer is held by a National. There is no regular training center as such, but training is given along with routine work and the recruits after acquisition of the necessary experience and licenses are graded throughout the lower cadres from apprentices to Senior Supervisors. At present the high cadres from Chief Engineer down through LME are filled by qualified non-Nationals who are foreign trained.

4. Burma provides no regular training school for civil flying personnel or ground crews. Pilots are obtained on the world market. Some Burmese have qualified or are qualifying as pilots. For the higher positions in the Operational Department (Flying Crew) and Engineering Department (Maintenance Crew), the source of personnel supply is still the world market, as very few Burmese are properly qualified for these positions. The state scholars now undergoing training in UK and USA are a potential source of supply, but the exact position as to how many men will become available from this source, and when, is not known. In the lower cadres, however, the situation is easier; the local colleges and schools are good sources of supply of promising personnel. Although there are of course certain positions, such as some appointments in the ground crews, which are non-technical in nature, the air crews, maintenance crews, and certain additional ground positions are highly technical. Technical work in aviation allows very little latitude for error; the consequences of error are too apt to be severe. The present need for technicians, and the prospective need in the future, bring into sharp focus the need for schools—schools for pilots, radio operators, mechanics of many types, etc., formal for theoretical training, combined with an expansion of the currently organized on-the-job training. It would be desirable to provide theoretical training in trade-schools and colleges so enough persons could be provided not only to fill present positions, but also to establish a small pool of additional persons available when work opportunities presented themselves. From trade-schools, individuals could then be employed in the lower graded positions and advanced as aptitude and skills developed or on-the-job training warranted. State scholars should continue to be selected from the best educated and most apt young men and sent to the UK for advanced training; the same principle applies to pilots. The broad comments contained in Section II of this report are applicable. Here, again, as in the principle discussed under the maintenance function, there appears sound logic in coordinating the needs of UBA in this respect with the similar needs of the BAF and with whatever needs exist, or may come into existence, with respect to privately owned or other commercial aircraft. Such combination would produce a volume of students more nearly able to justify a fully equipped and well staffed school. It could be done under the existing organizational structure, or under a Ministry of Air as recommended by Group Capt. Holroyd-Smith, or under still another agency which might be created by the GUB. This deficiency merits full consideration, evaluation, decision and implementation; such action is recommended.

D. FLIGHT SCHEDULES.

1. The Internal Flight Schedules vary with the seasons, load availabilities, and other factors. The following table gives a representative scheduling of UBA flights within Burma for a typical month.

	Region of Opertions	*Frequency*	*Monthly Total*
DAILY SERVICES:			
Rangoon-Bassein-Rangoon	S	1	30
Rangoon-Myaungmya-Rangoon	S	1	24
Rangoon-Moulmein-Rangoon	S	3	76
Rangoon-Thaton-Rangoon	S	1	30
Rangoon-Mandalay-Rangoon	C	1	34
		7	194
WEEKLY SERVICES:			
Rangoon-Mandalay-Lashio	N	1	4
Rangoon-Magwe-Meiktila-Mandalay	C	1	4
Rangoon-Lanywa-Pakokku	C	1	4
Rangoon-Heho-Rangoon	C	1	4
Rangoon-Heho-Mandalay-Lashio-Mandalay-Rangoon	N	1	4
Rangoon-Heho-Kentung	NE	1	4
Rangoon-Mandalay-Monywa-Kalemyo	N	1	4
Rangoon-Pakokku-Pauk-Gangaw	C	1	4
Rangoon-Mandalay-Shwebo-Mandalay-Monywa-Mandalay-Rangoon	N	1	4
Rangoon-Loikaw-Heho	C	2	8
Rangoon-Magwe-Meiktila	C	2	8
Rangoon-Mandalay-Bhamo-Myitkyina (fortnightly run to Patao)	N	2	8
Rangoon-Moulmein-Tavoy-Mergui	SE	2	8
Rangoon-Mandalay-Lashio-Mandalay-Monywa-Mandalay-Rangoon	N	2	8
Rangoon-Tavoy-Mergui	SE	4	16
		23	92
Monthly total services			286
Average number of daily services			10

SE. South East; S. South; C. Central; N. North; NE. North East.

The above scheduling represents 130,308 statute miles of operation and averages nearly 4,350 miles per day, the total unduplicated route miles according to the schedule being 4,430 miles.

2. External Flight Schedules began in November, 1950, with the introduction of bi-weekly services to Bangkok. In April, 1950, tri-weekly services to Chittagong, East Pakistan, were introduced, and in November, 1951, a bi-weekly service to Calcutta was introduced. These schedules can be summarized as follows:

WEEKLY SERVICES:

Route	*Country*	*Frequency*	*Monthly Total of Services*
Rangoon-Bangkok	Thailand	2	8
Rangoon-Chittagong via Akyab	East Pakistan	3	12
Rangoon-Calcutta via Akyab	India	2	8

The statute miles scheduled on external runs totaled 27,120 miles per month and the total unduplicated route are 1,467. The following summary represents the total of UBA scheduled operations, both within and beyond Burma.

	Av. No. of Services per day	*Av. Daily Scheduled Mileage*	*Total Monthly Schd. Miles*	*Unduplicated Route Miles*
Internal Division (within Burma)	10+	4,350	130,038	4,430
External Division (beyond Burma)	1	969	27,120	1,467
TOTAL:	11+	5,319	157,158	5,897

The above description of external flights involves international routes on a "short-haul" basis only. In this field it is considered that the UBA has a rightful place, and can compete with other international lines on a proper and adequate level of service and price. It is reasonable to anticipate that this "short-haul" external service may be extended to new routes in limited frequency schedules in the future, should potential business in passenger and freight traffic appear to warrant such action.

E. TRAFFIC.

1. Traffic data are kept in careful and comprehensive form by the UBA. A consolidated statement for the year 1949-50 showing passenger-miles and passenger load factor by month, and freight ton-miles with load factors for regularly scheduled and chartered flights by month, is shown in Table II. These data, and similar data for prior years, show a sharp diminution in passenger traffic during the rainy season, especially in passenger miles. The rainy season decline in freight miles is very great indeed. Load factors, however, are held to very profitable operations by schedule adjustment. These data represent air movements so large in relation to lift by ground transport that the artificiality of the market illustrated by the year 1949-50 appears to be again emphasized. Nevertheless, the capability of UBA to carry impressive lift is abundantly demonstrated. It is obvious that the airline, new and vital, will continue to accept substantial lift that falls naturally into its sphere, and that on the restoration of normal conditions it will be a very strong competitor in the transportation field.

2. With the completion of Mingaladon about June, 1952, as an International Airport capable of accepting any aircraft, international traffic at and through Mingaladon is certain to increase greatly. Mingaladon has a strategic position astride all major air routes through southeast Asia, and may well develop into an important aerial cross-roads, where the Far Eastern route from Europe divides into three main arteries; southeast traffic to Singapore, Indonesia and Australia; eastern traffic to Manila and Honolulu; and northeast traffic to Hongkong, Shanghai and Tokyo. Reasonable increase in passenger traffic is probable. A very considerable increase in air-freight may be expected as Burma itself develops and expands industrially, especially if those persons who are willing and able to pay the premium cost of air over surface freight may have the benefit of prompt customs clearance for air-freight. Delays of weeks in customs, which are said to occur with too great frequency under existing procedures, now subtract too much from the advantage of air-freight to permit significant growth in this business. This condition, to the extent it actually exists, is one which

TABLE II

TRAFFIC DATA FOR U.B.A., 1949-1950

Month and Year	PASSENGER			FREIGHT		
				Baggage, freight, and Mail Revenue Ton Miles (Short Tons)	*Load factor*	
	Passengers	*Passenger Miles*	*Load factor*	*Scheduled and Chartered*	*Scheduled flights*	*Chartered flights*
Oct. '49	11,622	2,488,476	58.4	846,261	75.1	87.6
Nov.	11,140	2,304,214	76.3	602,732	82.2	94.8
Dec.	11,520	2,423,354	71.2	623,144	81.2	95.8
Jan. '50	10,451	2,398,793	86.4	585,044	88.7	91.4
Feb.	10,612	2,236,973	73.5	642,430	91.5	90.5
Mar.	11,850	2,708,718	64.2	827,623	77.6	82.1
Apr.	14,214	2,896,792	62.9	726,280	78.5	85.5
May	14,089	2,979,055	69.6	500,223	76.2	81.5
June	12,032	2,490,589	71.9	284,927	74.9	81.1
July	11,024	2,086,053	68.4	154,046	68.4	80.2
Aug.	11,109	1,961,931	62.0	88,909	63.8	68.2
Sept.	11,635	1,874,492	61.0	127,483	66.9	88.1

could be remedied by the simplification of administrative procedures, and promptness in the execution of such simplified procedures.

3. As is done generally by commercial airlines, the UBA maintains insurance coverage for its aircraft and equipment, and personal and contingent liabilities to protect itself from unforeseeable losses. This includes direct indemnification for loss or damage to its aircraft and equipment, as well as death or injury to its personnel. The UBA has recently taken steps to effect insurance for third parties to the extent of an automatic payment of £750 to any passenger suffering death or serious injury by accident on its aircraft. Beyond this figure the UBA carries its own third party insurance. The safety record established by UBA to date is excellent, with only three accidents of significance and only one involving loss of life. This is indeed a remarkably fine record, connoting skill of pilots and excellence of maintenance of aircraft.

4. The plans for the development of UBA, and definite programs in support of such plans, are under constant consideration by the Board. The UBA was originally established as a Government-owned monopoly, with the expectation of diminishing losses for the first three or four years, and operation at a profit beginning with the 4th or 5th year. The insurrection has made Burma "air-minded" through compulsion, as other modes of transportation were and are seriously interrupted. Hence, UBA has operated at a profit from the beginning, and without GUB subsidy, other than airports as later discussed. Operations approximate a 70% load factor for passengers, 80% for freight. These load factors can continue only so long as water, rail and highway transport continue interrupted or schedules are adjusted to match 'available loads. Upon the restoration of ground transportation to normal operating conditions; the UBA must compete for business.

F. FLIGHT CONTROL AND SIGNAL COMMUNICATIONS.

1. The DCA exercises flight control over all aircraft in an area allotted by the International Civil Aviation Organization, known as the Rangoon Flight Information Region. This area is larger than Burma, bordered on the southeast by 100° East Longitude, on the east and north by the geographic boundary of Burma, on the west by the boundary of Burma to a point on the 92° East Longitude near Akyab and south of Akyab by that meridian, and on the south by the 10° Latitude, North. Control is taken of all aircraft entering this zone, whether for landing within or over-flying Burma. Control is exercised by radio and involves three successive stages: initially, area control, then approach control, and finally airport control for landing aircraft. For over-flying aircraft, area control only is applicable; for landing aircraft, the full cycle is necessary. Aircraft making flights originating and terminating within Burma are dispatched, tracked, and brought in for landing where radio is available under radio signal communication between airports of origin, the aircraft itself, and the airport of destination. A 24 hour per day continuous "watch" is carried on all types of control; the highest quality radio communication is patently required.

2. To assist the DCA in control, a contract has been made with International Aeradio, Limited (IAL) who provide the radio equipment, mechanics and operators at Akyab, Rangoon and Mergui, the three stations on the International air route. IAL provide only the mechanics and operators to man the radio equipment provided by the DCA at Bassein, Heho, Lashio, Magwe, Mandalay, Moulmein, Myitkyina and Tavoy. At each of the above-named eleven airports, DCA staff is assigned the duty of actual control ot aircraft. These staff personnel and the employees of IAL form a team at each installation, the DCA personnel performing actual control, passing written instructions to the radio operators for code transmission for the accomplishment of control. With the equipment available at the eleven airports above indicated, transmission of radio messages is by voice and code. Voice transmissions are by DCA personnel; code by IAL. The "point-to-point" or "ground-to-ground" messages are normally by code; ground to air are normally by voice. This net as established covers the International route and the most heavily travelled internal routes; it is being extended to other airports as rapidly as equipment and personnel become available.

3. IAL has a total of approximately 35 employees in Burma engaged in the above described, sensitive work. It would appear logical and definitely in the interest of the GUB that plans should be directed toward training Burmese personnel for the early assumption of this entire function, with Burmese Nationals using GUB-owned equipment. This would actually produce a slight saving to the GUB in annual operating costs; a very modest capital investment in radio equipment would be required initially. It would involve the fully adequate training of required technicians, the procurement of additional radio equipment, and direction and management of a high order of skill. As it is imperative that this work be done with real precision, the actual need for a training school as previously discussed is again emphasized.

G. FISCAL.

1. Except for the initial loan of Rs. 50 lakhs from the Government, the UBA has not experienced further need for funding operations, from the GUB or other sources. The expansion of its operating capacity in 1950 by acquisition ot nine additional aircraft at a cost of Rs. 16.2 lakhs was paid for from its revenue surplus, after

repayment to the GUB of the original advance of Rs. 50 lakhs. Operating profits for each fiscal year have been quite substantial. Operating revenue for the three years of operation are as follows:

1948/49	Rs. 157.7 lakhs	
1949/50	Rs. 252.7 lakhs	
1950/51	Rs. 125.9 lakhs	(provisional)

Operating revenue for 1950/51 is broken downs as follows:

Tickets	Rs. 86,42,562—10—0
Baggage	3,56,302—14—0
Freight	17,83,766— 2—0
Mails	4,21,675— 5—10
Charters, etc.	13,82,588— 9—0
	Rs. 125,86,895— 8—10

2. A schedule of current tariffs also showing the distances between points is tabulated on following pages. Passenger fares are based upon a sequence of rates, viz: 4.82/5.18/5.54 annas per passenger-mile, the basic standard rate being 5.18 annas. At this rate the Dakota revenue returns break even at 50% load factor, based on an operating cost of Rs. 600 per hour or Rs. 4/6 per plane-mile. The freight rate sequence is .020/.024/.028 annas per pound-mile; in September, 1950, because of low availabilities, a flat cut of 15% was applied on all freight rates within Burma, and a further 15% rebate was allowed on all freight shipped direct to Rangoon from out-stations within Burma.

3. The UBA pays to the GUB for collection in general revenues a landing fee of Rs. 10 for each Dove and Rs. 50 for each Dakota landed at any airport having radio control. It pays landing fees at no other airports, nor for other services except a quarterly rental of Rs. 3,000 for use of the hangar at Mingaladon. It carries air mail for the GUB to any scheduled destination at a flat rate of Rs. 1/8 per pound, the minimum charge being for one pound.

4. A profit and loss statement for UBA for the fiscal year 1949/50 is enclosed as Table III. An analysis of this and prior statements, together with preliminary data for later periods, shows wide fluctuations in the total revenues produced, as well as wide fluctuations in the sources of such revenue, especially in freight and charter business. This is attributable almost entirely to the wide variation in the availability and certainty of ground transport. Passenger, mail and excess baggage revenues generally reflect reasonably steady growth through this period. Actual conditions through these years have departed too far from the normal to provide a firm basis for future predictions of business volume. Operational problems also have their effect in such considerations. The lack of pilots is a current problem of magnitude, adversely affects business volume, and exists now as an obstacle of importance. It nevertheless appears from available data, even though limited to a few years and fretted with imponderables as it is, that the UBA has attained a secure place in transportation in Burma, and that its business volume for the near-term may hold reasonably close to fiscal year 50/51 levels under restored normal conditions with its inevitable competition. Over the long-term, there would seem to be no doubt of exceeding fiscal year 50/51 business volume, and by increasing annual margins.

TABLE III

UNION OF BURMA AIRWAYS
PROFIT & LOSS ACCOUNT FOR THE PERIOD 1ST OCTOBER 1949 TO 30TH SEPTEMBER 1950

To *Operating Expenses*			
Flying Operation Expenses	Rs. 20,22,463- 1-1		
Ground Operation Expenses	4,45,708- 8-3		
Traffic, Passengers, Freight Service Expenses	8,80,903-14-3		
General Administrative Expenses	2,98,459- 2-5		
			36,47,534-10-0
To *Depreciation*			
On Aircraft Fleet, Spares (Dove, Dakota)	8,14,369- 4-1		
Plant, Machinery, Ground Equipment Tools	27,999- 1-4		
Motor Vehicles	85,316-14-8		
Furniture, Fixture, Office Equipt.	21,550- 5-2		9,49,235- 9-3
To Reserve for Losses due to Obsolescence on Aircraft, Spares			2,00,000- 0-0
To Interest payable on loan received from Government			1,44,657- 8-0
To Proportion of Preliminary expenses written off			29,843-12-0
Balance being net profit for the period carried forward to Balance Sheet			64,89,666- 1-1
			Rs. 114,60,937- 8-4

Sd/
Chief Accountant,
Union of Burma Airways

By *Transportation Revenue*			
Passage	Rs. 84,72,721- 3-0		
Freight	60,54,104- 2-7		
Excess Baggage	4,52,159-15-0		
Carriage of Mails	3,61,005- 3-9		
Income from Charter of own and Outside Aircraft	99,30,115- 3-0		
	252,70,105-11-4		
Less Cost of Chartering Outside Aircraft	138,66,853- 7-0		
			114,03,252- 4-4
Incidental Revenue			
Booking Cancellation Fees	6,001-14-0		
Sundry Receipts	19,531- 1-8		
Profit on Foreign Exchange	347- 6-7		
			25,880- 6-3
Insurance Claim Receipts (XY-ABO accident at Myaungmya)			5,586-10-0
Engineering Job Recipts			9,839- 1-6
Interest received on Investments A/c.			
3 years Treasury Bills— Rs. 9,29,000/- bearing 2½% interest	4,187- 5-9		
3 months Treasury Bonds— Rs. 50,00,000/- bearing ½% interest	12,191-12-6		
			16,379- 2-3
			Rs. 114,60,937- 8-4

Sd/
General Manager,
Union of Burma Airways

H. FUTURE DEVELOPMENT.

1. Aviation is very young in relation to other modes of transportation. Aviation is still so dynamic in its development that airports become obsolescent and obsolete with relative rapidity, workshop and communication facilities require progressive betterment to keep abreast of improvements in aircraft, and aircraft themselves are being outmoded by new designs at a rate only slightly less rapid than in the past decade. These factors must continue to be taken into full account by the GUB, the Board and the UBA, if the transport system developed by UBA is to continue to serve its purpose.

2. The DCA is the head of the agency established for presenting aviation matters to higher authority; coordination of airfield construction and maintenance, and preparation of plans and programs therefor; the establishment, maintenance and operation of signal communications for control of and signals to aircraft in flight; and finally in standards for aircraft maintenance, and in physical arrangements therefor. The UBA has great concern in all of the matters handled by the DCA, and in addition is directly involved in aircraft purchase and maintenance, including the flow of required spare parts and arrangements for heavy maintenance work by contract, and the provision of transportation service. The War Office carries on practically all of these identical administrative functions, frequently in the identical form, on behalf of Military Aviation. These matters relate to administrative and logistical function, separate and distinct from actual "operations", either civil or military. Training of pilots and ground technicians is a similar activity needing positive improvement. No one of these Governmental agencies is large enough in sheer volume to support these activities on a plane of full development and acceptable efficiency. Their combination by merger of administrative function, or by very close coordination, encroaching in no way upon operations as such, would appear to be in the interest of the Ministry of Transportation and Communications, the War Office, and the GUB. Such merger or complete coordination of administrative function could be attained most efficiently and effectively by bringing these functions under a single responsible head. Experiences of other countries vary in solving this and similar problems in organizational structure. The establishment of a Ministry for Air in the UK and in Holland proved valuable in terms of efficiency and effectiveness; such action has been recommended to the GUB heretofore by Group Captain Holroyd-Smith, then DCA. There is much to support this recommendation which it is believed should be most faithfully considered. Less positive action in terms of undertaking to attain the desired ends by cooperation would be productive of good results, but less effective. A further alternative may lie in the establishment of a new agency probably under the Ministry of Transport and Communication, to assume training, maintenance, and spare parts supply, among other things, for all aviation interests in Burma. The problem is broad in scope and has many obvious difficulties, but also has potential benefits as important as to demand attainment. It is recommended that this problem receive early and faithful analysis, evaluation and decision. The establishment of a Ministry for Air is the strongest action and probably would produce the greatest coordination and benefit.

I. CONCLUSIONS AND RECOMMENDATIONS.

1. The following proposals appear to have positive merit. It is recommended that each be analyzed and evaluated in the light of complete facts bearing on each, with a view toward the timely adoption and implementation of those supported by such examination:

a. That a thorough analysis and evaluation be made with a view to establishing the optimum method of coordinating and enhancing the administrative functions of personnel training, work-shop maintenance, and spare-parts supply in Civil and Military Aviation.

b. That the training of pilots, radio operators, and maintenance technicians particularly, as well as other technical and semi-technical personnel required by aviation, be greatly expanded in formal schools of the GUB for theoretical training combined with carefully organized and supervised on-the-job training.

c. That there be established at Mingaladon, or other central location, a workshop adequate for the complete overhaul of aircraft, including engines, propellers and airframes, capable of and utilized for the overhaul of all Burmese Civil and Military aircraft.

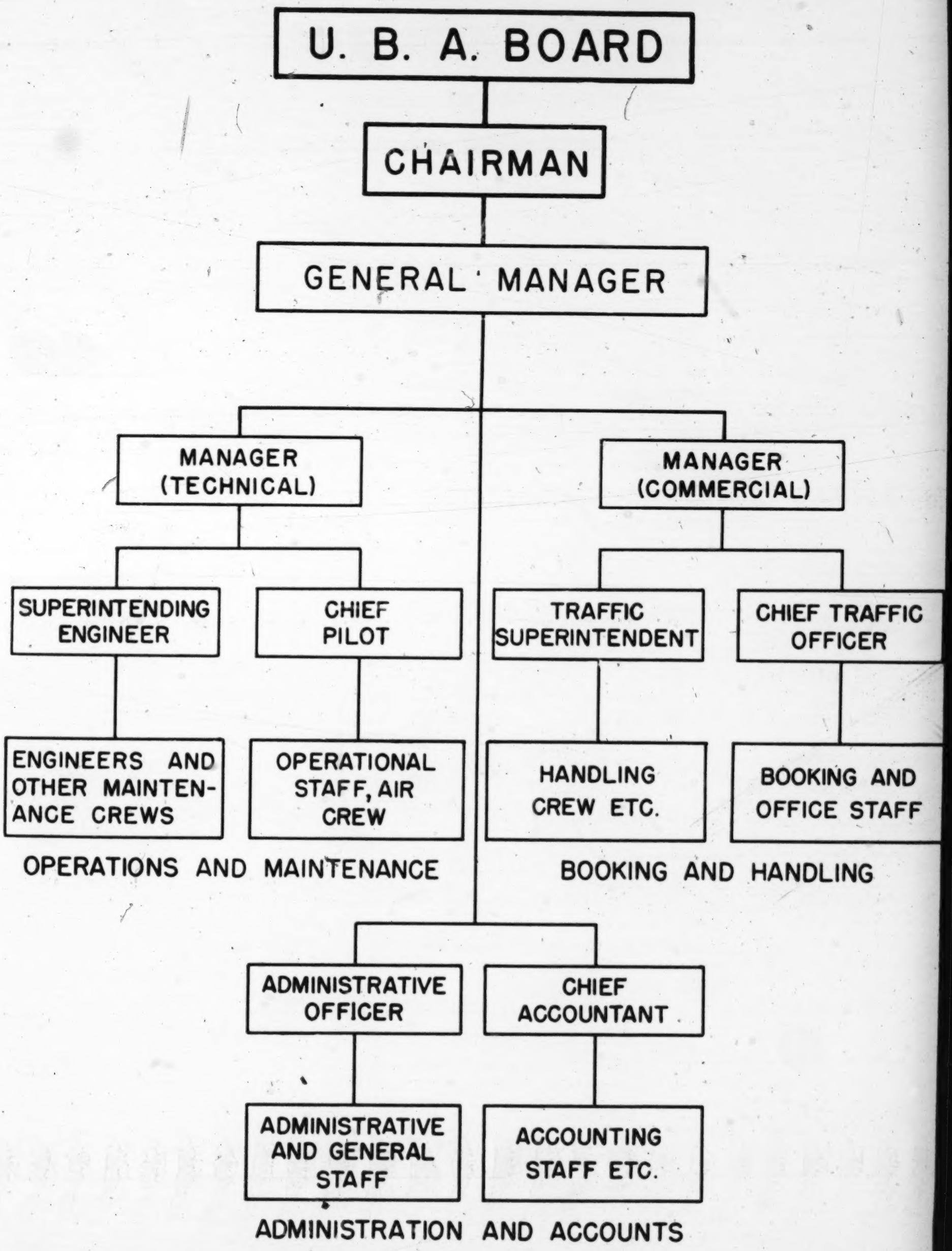
d. That there be developed, realistically and in complete detail, a specific plan for the direct operation under the DCA of the Radio Control and Signal Network for the airways in Burma, now contracted in part to International Aeradio, Limited, and that such plan be then implemented at the earliest practicable date.

e. That the procedures required and involved in the clearance of air-freight through customs be revised to reduce greatly the elapsed time consumed in such clearance.

f. That a master plan be prepared and utilized by the DCA for the phased physical development and betterment of airports, bringing each airport used for regularly scheduled commercial flights to the full standard for safety requirements.

g. That plans be made for the funding of phased aircraft replacement, which will obviously become necessary in due course, on the realistic basis of the probable cost of replacement aircraft.

ORGANIZATION CHART
UNION OF BURMA AIRWAYS



DATA ON AIRPORTS IN BURMA

NAME	ALTITUDE IN FEET	PARTICULARS OF RUNWAYS				
		DIMENSIONS IN FEET	SURFACE	CAPABILITY OF EXTENDING RUNWAY	SUITABILITY MAXIMUM ALL UP WEIGHT IN POUNDS	NIGHT LIGHTING
AKYAB #13 ...	30	6,000 × 150	Double PSP on on Bithess	600'	80,000	Emergency
ANISAKAN ...	3,100	3,900 × 150	Grass on Gravel base	300'	25,500	Nil
BASSEIN ...	20	3,300 × 150	Laterite	1,200'	30,000	Emergency
BHAMO ...	360	6,000 × 150	Tarmac	NA	60,000	Nil
HEHO ...	3,858	5,400 × 150	Laterite	300'	30,000	Emergency
HENZADA ...	25	3,600 × 150	Rolled Earth	NA	*28,000	Nil
KALEMYO ...	100	3,600 × 150	Gravel	1,200'	*30,000	Nil
KATHA ...	320	3,600 × 150	Laterite	NA	*30,000	Nil
KENG TUNG ...	2,750	4,000 × 100	Gravel	NA	26,000	Nil
KYAUKPYU ...	20	4,488 × 100	Single PSP	200'	30,000	Nil
LANYWA #14 ...	175	4,000 × 70	Tarmac	No	30,000	Nil
LASHIO ...	2,450	4,500 × 100	Tarmac	600'	30,000	Emergency
LOIKAW ...	2,800	4,525 × 75	Metalled	NA	27,000	Nil
MAGWE ...	275	4,800 × 120	Gravel	No	*30,000	Emergency
MANDALAY ...	252	3,990 × 150	Tarmac	2,000'	30,000	Emergency
MEIKTILA ...	600	6,000 × 150	Laterite	300'	30,000	Nil
MERGUI ...	75	4,500 × 150	#11	900'	30,000	Emergency
MOULMEIN ...	150	5,100 × 150	Laterite	300'	30,000	Emergency
MU-SE ...	2,650	4,500 × 100	Tarmac	NA	30,000	Nil
MYITKYINA (S) #15	450	6,000 × 150	Tarmac	No	60,000	Emergency
MYAUNGMYA ...	20	4,800 × 150	Laterite	NA	*30,000	Nil
MOMEIK ...	600	5,280 × 150	Rolled Earth #16	NA	*28,000	Nil
NAMSANG ...	3,000	5,280 × 150	Rolled Earth	NA	30,000	Nil
PUTAO ...	2,000	3,300 × 80	Rolled Gravel	2,000'	*25,000	Nil
PAKÔKKU ...	150	4,050 × 150	Gravel 2640' Rolled Earth 1410'	NA	30,000	Nil
RANGOON #12 ...	100	5,300 × 200	Concrete	600'	300,000	*See* remarks
SHWEBO ...	500	3,000 × 150	Gravel	NA	30,000	Nil
TAVOY ...	84	3,600 × 150	Gravel	NA	30,000	Emergency
TOUNGOO ...	150	4,800 × 120	Single PSP on Bithess.	NA	30,000	Nil

NOTE.– In addition to the above 29 airfields listed in the GUB "Notice to Airmen" and in the Civil Airport Register, there are other airfields in Burma some of these are used regularly by UBA, for example Mônywa, for regularly scheduled flights. In addition there are still other airfields shown neither in th

DATA ON AIRPORTS IN BURMA AS LISTED BY DCA.

PARTICULARS OF RUNWAYS					FACILITIES				
MENSIONS IN FEET	SURFACE	CAPABILITY OF EXTENDING RUNWAY	SUITABILITY MAXIMUM ALL UP WEIGHT IN POUNDS	NIGHT LIGHTING	RADIO	TERMINAL BUILDING	GASOLINE OIL ROUTINE SERVICE	QUARTERS FOR AIRPORT STAFF	
000 × 150	Double PSP on on Bithess	600'	80,000	Emergency	# 1,2,3,4,5	Yes	Yes	Yes	
900 × 150	Grass on Gravel base	300'	25,500	Nil	Nil	Nil	Nil	Temporary Nil	
300 × 150	Laterite	1,200'	30,000	Emergency	# 1,2,3,6	Nil	Nil	Yes	
000 × 150	Tarmac	NA	60,000	Nil	Nil	Nil	Nil	Nil	
400 × 150	Laterite	300'	30,000	Emergency	# 1,2,3,6	Nil	Nil	Yes	
600 × 150	Rolled Earth	NA	*28,000	Nil	Nil	Nil	Nil	Nil	
600 × 150	Gravel	1,200'	*30,000	Nil	Nil	Nil	Nil	Yes	
600 × 150	Laterite	NA	*30,000	Nil	Nil	Nil	Nil	Nil	
000 × 100	Gravel	NA	26,000	Nil	Nil	Nil	Nil	Yes	
488 × 100	Single PSP	200'	30,000	Nil	Nil	Nil	Nil	Nil	
000 × 70	Tarmac	No	30,000	Nil	Nil	Nil	Yes	NA	
500 × 100	Tarmac	600'	30,000	Emergency	# 1,2,3,6	Nil	Nil	Yes	
525 × 75	Metalled	NA	27,000	Nil	Nil	Nil	Nil	Nil	
800 × 120	Gravel	No	*30,000	Emergency	# 1,2,3,6	Nil	Nil	Yes	
990 × 150	Tarmac	2,000'	30,000	Emergency	# 1,2,3,6	Yes	Yes	Yes	
000 × 150	Laterite	300'	30,000	Nil	Nil	Nil	Nil	Nil	
500 × 150	# 11	900'	30,000	Emergency	# 1,2,3,4	Yes	Yes	Yes	
100 × 150	Laterite	300'	30,000	Emergency	# 1,2,3,6	Nil	Nil	Yes	
500 × 100	Tarmac	NA	30,000	Nil	Nil	Nil	Nil	Nil	
000 × 150	Tarmac	No	60,000	Emergency	# 1,2,3,6	Nil	Nil	Yes	
800 × 150	Laterite	NA	*30,000	Nil	Nil	Nil	Nil	Nil	
280 × 150	Rolled Earth # 16	NA	*28,000	Nil	Nil	Nil	Nil	Nil	
280 × 150	Rolled Earth	NA	30,000	Nil	Nil	Nil	Nil	Nil	
600 × 80	Rolled Gravel	2,000'	*25,000	Nil	Nil	Nil	Nil	Nil	
950 × 150	Gravel 2640' Rolled Earth 1410'	NA	30,000	Nil	Nil	Nil	Nil	Nil	
00 × 200	Concrete	600'	300,000	*See* remarks	# 1,2,3,4,5,6,7,8,9,10	Yes	Yes	Yes	
000 × 150	Gravel	NA	30,000	Nil	Nil	Nil	Nil	Nil	
00 × 150	Gravel	NA	30,000	Emergency	# 1,2,3,6	Nil	Nil	Nil	
00 × 120	Single PSP on Bithess.	NA	30,000	Nil	Nil	Nil	Nil	Nil	

Legend

Emergency—night lighting by goose neck Flare.

* —fair weather only.

PSP —pierced steel plank.

NA —information not available.

1.—Aerodrome Control.
2.—Internal Service R/T.
3.—VHF D/F.
4.—Radio Beacon.
5.—HF D/F.
6.—Approach Control.
7.—Locator Beacon.
8.—Responder Beacon.
9.—Rangoon Broadcaster.
10.—Other facilities.
11.—Tarmac 1100 yds; gravel and laterite 400 yds.
12.—Mingaladon; *see* text for other comments.
13.—Airport has hangar, old and not currently used.
14.—Privately owned airport available for civil use.
15.—Myitkyina south has excellent hangar containing, however, no facilities.
16. Landing strip has central gravel strip 75' wide.

NOTE.—Rangoon (Mingaladon), Akyab, and Mergui have Customs, Health and Immigration Officials on duty as these are international Airports.

in the GUB "Notice to Airmen" and in the Civil Airport Register, there are other airfields in Burma. Five additional such airfields are shown on the map, at the end of this section, namely Kyauktu, Gangaw, Mônywa, Pauk and Thatôn; Mônywa, for regularly scheduled flights. In addition there are still other airfields shown neither in this schedule or on the map such as 3 air strips near and south-west of Myitkyina.

TABLE 1.

BURMA

AIRFIELDS

LEGEND

RUNWAY SURFACES

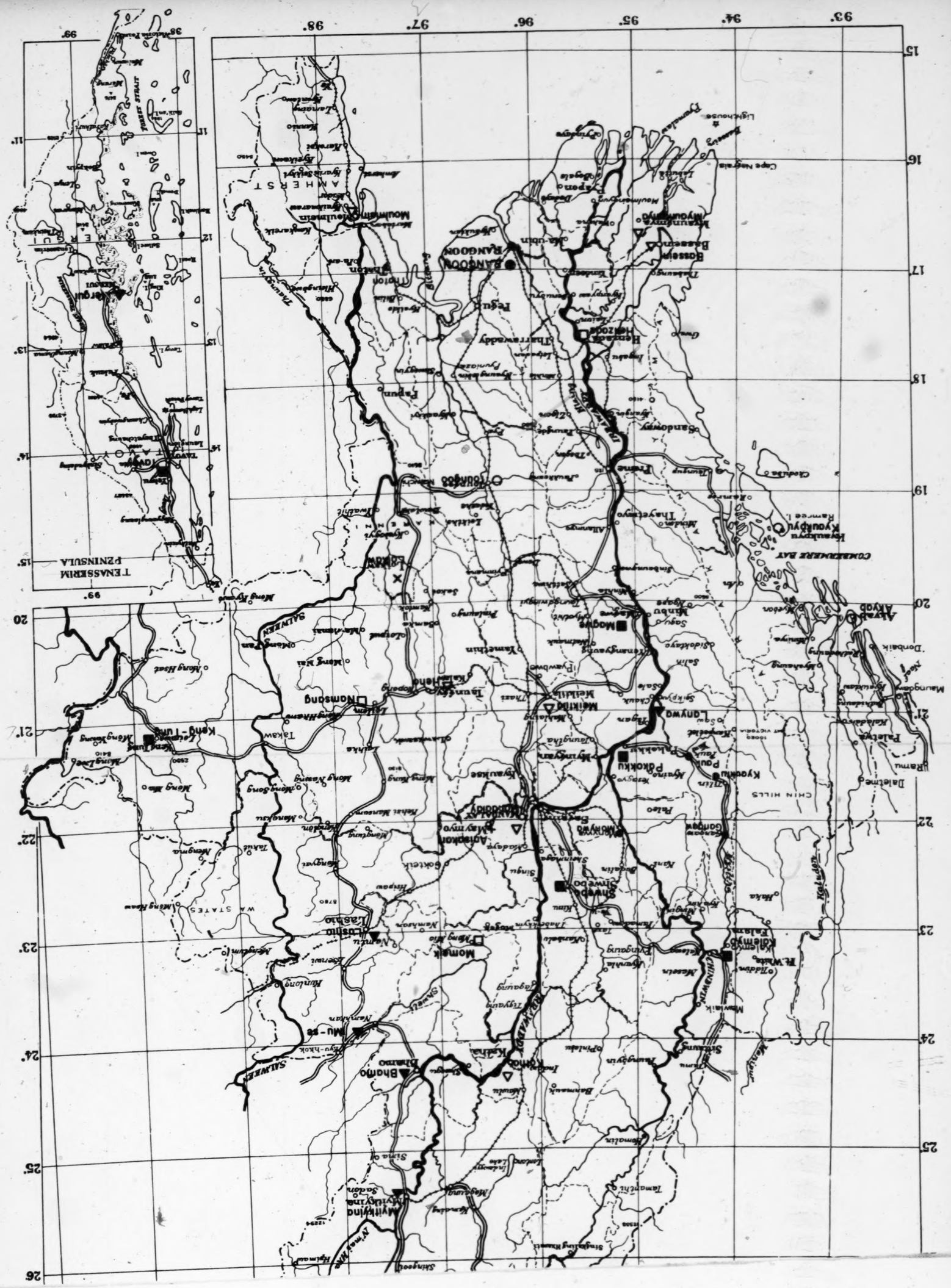
- ○ PIERCED STEEL PLANK
- † GRASS ON GRAVEL BASE
- △ LATERITE
- ▲ TARMAC
- □ ROLLED EARTH
- ■ GRAVEL
- × METALED
- ● CONCRETE

- • ADDITIONAL AIRFIELDS, SOME OF WHICH ARE IN REGULAR USE.

92° 93° 94° 95° 96° 97° 98° 99° 100° 101°

28° 27° 26° 25° 24° 23° 22° 21° 20°

Putao (Fort Hertz)
Myitkyina
Bhamo
Mu-se
Lashio
Momeik
Shwebo
Monywa
Katha
Lanywa
Pakokku
Magwe
Namsang
Keng-Tung
Hukawng Valley
CHIN HILLS
WA STATES
TENASSERIM PENINSULA
COMBERMERE BAY


TENASSERIM
PENINSULA
ANDAMAN SEA
GULF OF MARTABAN
ANDAMAN ISLANDS
NICOBAR ISLANDS
RANGOON
Moulmein
Thaton
Pegu
Henzada
Bassein
Myaungmya
Maubin
Hinthada
Prome
Thayetmyo
Tounghoo
Shwebo
Monywa
Katha
Mogaung
Mohnyin
Myitkyina
Bhamo
Momeik
Lashio
Kyaukpyu
Sandoway
Akyab
Maungdaw
Kalemyo
Kalewa
Tamu
Kyaukse
Meiktila
Thazi
Yamethin
Pyawbwe
Thandwe
Gokteik
Namkham
Lonkin
Kengtung
Taunggyi
Loilem
Mong Nai
Mong Hsat
Mong Yawng
Mong Mit
Mong Pawn
Kengtung
Tachileik
Mong Ping
Kyaington
Tawngpeng
Loilong
Mong Kung
Mong Nawng
Hsipaw
Lashio
Kyaukme
Namtu
Mong Yai
Mong Nai
Mong Hsat

UNION OF BURMA AIRWAYS

PROFIT AND LOSS ACCOUNT FOR THE PERIOD 1st OCTOBER 1949 TO 30th SEPTEMBER 1950

	Rs.	A.	P.	Rs.	A.	P.
To: *Operating Expenses–*						
Flying Operation Expenses	20,22,463	1	1			
Ground Operation Expenses	4,45,708	8	3			
Traffic, Passengers, Freight Service Expenses	8,80,903	14	3			
General Administrative Expenses	2,98,459	2	5			
				36,47,534	10	0
To: *Depreciation–*						
On Aircraft Fleet, Spares (Dove, Dakota)	8,14,369	4	1			
Plant, Machinery, Ground Equipment Tools	27,999	1	4			
Motor Vehicles	85,316	14	8			
Furniture, Fixture, Office Equipment	21,550	5	2			
				9,49,235	9	3
Reserve for Losses due to Obsolescence on Aircraft, Spares				2,00,000	0	0
Interest payable on loan received from Government ...				1,44,657	8	0
Proportion of Preliminary Expenses written off				29,843	12	0
Balance being net profit for the period carried forward to Balance Sheet				64,89,666	1	1
				1,14,60,937	8	4

	Rs.	A.	P.	Rs.	A.	P.
By: *Transportation Revenue–*						
Passage						
Freight						
Excess Baggage						
Carriage of Mails						
Income from Charter of Own and Outside Aircraft						
Less Cost of Chartering Outside Aircraft						
By: *Incidental Revenue–*						
Booking Cancellation Fees						
Sundry Receipts						
Profit on Foreign Exchange						
Insurance Claim Receipts (XY-ABO accident						
Engineering Job Receipts						
By: *Interest received on Investments Accounts–*						
Three years Treasury Bills – Rs. 9,29,000 be						
cent interest						
Three months Treasury Bonds – Rs. 50,00,000						
cent interest						

BALANCE SHEET AS AT 30th SEPTEMBER 1950

LIABILITIES

	Rs.	A.	P.	Rs.	A.	P.
Sanctioned Capital				50,00,000	0	0
Loan Capital–						
Original Loan from Government of the Union of Burma at 3 per cent per annum	50,00,000	0	0			
Repayment during 1949-50	25,00,000	0	0			
				25,00,000	0	0
Reserve Accounts–						
Capital Reserve				25,00,000	0	0
Depreciation on Aircraft, Aircraft Spares	12,53,617	5	9			
Depreciation on Plant, Machinery, W/shop Equipment Tools	37,771	12	8			
Depreciation on Motor Vehicles	1,27,345	9	4			
Depreciation on Furniture, Fixtures, Office Equipment ...	47,873	1	8			
				14,66,607	13	5
Losses on Obsolete Stores				4,00,000	0	0
Reserve Interest				1,44,657	8	0
Reserve Audit Fees				36,800	0	0
Reserve Bad Debts				50,000	0	0
Reserve Unforeseen Liabilities	2,00,000	0	0			
Less Payments made during 49/50	21,393	7	9			
				1,78,606	8	3
Sundry Creditors, Credit Balances–						
Sundry Creditors (Trade)	6,52,884	2	6			
Sundry Credit Balances	72,347	2	2			
				7,25,231	4	8
Sundry Revenue received in Advance				44,757	8	0
Profit and Loss Account Balance as per last Balance Sheet	24,13,017	13	1			
Add Balance as per prior year Revenue Account	30,509	4	8			
Add Net Profit as per accompanying Profit and Loss Account	64,89,666	1	1			
	89,33,193	2	10			
Less Transferred to Capital Reserve	25,00,000	0	0	64,33,193	2	10
				1,44,79,853	13	2

ASSETS

	Rs.	A.	P.	Rs.	A.	P.
Fleet Account at Cost at 30-9-50–						
De Havilland Dove Aircraft XY-ABN, ABR, A						
Field Aircraft Services XY-ACL, ACM, ACO, ACT						
Spares Aircraft, Power Units, Engine, Airfram Radio, etc. (both Dove, Dakota) at cost at						
Plant, Machinery, Ground W/shop Equipment dated 30-9-50						
Motor Vehicles at cost dated 30-9-50 ...						
Furniture, Fixture, Office Equipment at cost						
Stock of Stores, spares (both Dove, Dakota) o 30-9-50						
Stock of Stationery on hand as at 30-9-50						
Sundry Debtors debit balances–						
Sundry Debtors (Trade)						
Sundry Debit Balances						
Insurance prepaid						
Prepaid Expenses						
Preliminary Expenses–						
Less Written off						
Investments–						
3 Years T/Bonds Bearing 2½ per cent interes						
3 Months T/Bills Bearing ½ per cent interest						
Cash Balances–						
On current account with Union Bank ...						
Cash on hand						

UNION OF BURMA AIRWAYS

PROFIT AND LOSS ACCOUNT FOR THE PERIOD 1st OCTOBER 1949 TO 30th SEPTEMBER 1950

	Rs.	A.	P.	Rs.	A.	P.
Expenses–						
; Operation Expenses	20,22,463	1	1			
d Operation Expenses	4,45,708	8	3			
c, Passengers, Freight Service Expenses	8,80,903	14	3			
al Administrative Expenses	2,98,459	2	5			
				36,47,534	10	0
ion–						
craft Fleet, Spares (Dove, Dakota)	8,14,369	4	1			
Machinery, Ground Equipment Tools	27,999	1	4			
Vehicles	85,316	14	8			
ure, Fixture, Office Equipment	21,550	5	2			
				9,49,235	9	3
e for Losses due to Obsolescence on Aircraft, Spares				2,00,000	0	0
t payable on loan received from Government ...				1,44,657	8	0
tion of Preliminary Expenses written off				29,843	12	0
e being net profit for the period carried forward to nce Sheet				64,89,666	1	1
				1,14,60,937	8	4

	Rs.	A.	P.	Rs.	A.	P.
By: *Transportation Revenue–*						
Passage	84,72,721	3	0			
Freight	60,54,104	2	7			
Excess Baggage	4,52,159	15	0			
Carriage of Mails	3,61,005	3	9			
Income from Charter of Own and Outside Aircraft ...	99,30,115	3	0			
	2,52,70,105	11	4			
Less Cost of Chartering Outside Aircraft	1,38,66,853	7	0			
By: *Incidental Revenue–*				1,14,03,252	4	4
Booking Cancellation Fees	6,001	14	0			
Sundry Receipts	19,531	1	8			
Profit on Foreign Exchange	347	6	7			
Insurance Claim Receipts (XY-ABO accident at Myaungmya)				25,880	6	3
Engineering Job Receipts				5,586	10	0
				9,839	1	6
By: *Interest received on Investments Accounts–*						
Three years Treasury Bills – Rs. 9,29,000 bearing 2½ per cent interest	4,187	5	9			
Three months Treasury Bonds – Rs. 50,00,000 bearing ½ per cent interest	12,191	12	6			
				16,379	2	3
				1,14,60,937	8	4

BALANCE SHEET AS AT 30th SEPTEMBER 1950

LIABILITIES

	Rs.	A.	P.	Rs.	A.	P.
ed Capital				50,00,000	0	0
Loan from Government of the Union of Burma at 3 per r annum	50,00,000	0	0			
at during 1949-50	25,00,000	0	0			
–				25,00,000	0	0
eserve				25,00,000	0	0
ion on Aircraft, Aircraft Spares	12,53,617	5	9			
ion on Plant, Machinery, W/shop Equipment Tools	37,771	12	8			
ion on Motor Vehicles	1,27,345	9	4			
on on Furniture, Fixtures, Office Equipment ...	47,873	1	8			
				14,66,607	13	5
Obsolete Stores				4,00,000	0	0
nterest				1,44,657	8	0
udit Fees				36,800	0	0
ad Debts				50,000	0	0
nforeseen Liabilities	2,00,000	0	0			
ments made during 49/50	21,393	7	9			
				1,78,606	8	3
redit Balances–						
ditors (Trade)	6,52,884	2	6			
dit Balances	72,347	2	2			
				7,25,231	4	8
enue received in Advance				44,757	8	0
Loss Account Balance as per last Balance Sheet	24,13,017	13	1			
e as per prior year Revenue Account	30,509	4	8			
ofit as per accompanying Profit and Loss Account	64,89,666	1	1			
	89,33,193	2	10			
ferred to Capital Reserve	25,00,000	0	0	64,33,193	2	10
				1,44,79,853	13	2

ASSETS

	Rs.	A.	P.	Rs.	A.	P.
Fleet Account at Cost at 30-9-50–						
De Havilland Dove Aircraft XY-ABN, ABR, ABQ, ABS, ABP	10,85,124	10	0			
Field Aircraft Services XY-ACL, ACM, ACO, ACP, ACQ, ACS, ACT	11,90,513	15	2			
				22,75,638	9	2
Spares Aircraft, Power Units, Engine, Airframe, Propeller, Radio, etc. (both Dove, Dakota) at cost at 30-9-50 ...				7,23,029	0	0
Plant, Machinery, Ground W/shop Equipment Tools at cost dated 30-9-50				1,11,996	5	9
Motor Vehicles at cost dated 30-9-50				2,68,137	3	0
Furniture, Fixture, Office Equipment at cost dated 30-9-50				1,31,601	7	0
Stock of Stores, spares (both Dove, Dakota) on hand as at 30-9-50				3,60,703	6	6
Stock of Stationery on hand as at 30-9-50				17,982	1	8
Sundry Debtors debit balances–						
Sundry Debtors (Trade)	23,74,723	4	7			
Sundry Debit Balances	10,42,441	2	8			
Insurance prepaid	1,30,455	0	6			
Prepaid Expenses	40,371	5	0			
				35,87,990	12	9
Preliminary Expenses–	59,687	8	0			
Less Written off	29,843	12	0			
				29,843	12	0
Investments–						
3 Years T/Bonds Bearing 2½ per cent interest per annum ...	9,29,000	0	0			
3 Months T/Bills Bearing ½ per cent interest per annum ...	50,00,000	0	0			
				59,29,000	0	0
Cash Balances–						
On current account with Union Bank	9,42,839	7	4			
Cash on hand	1,01,091	12	0			
				10,43,931	3	4
				1,44,79,853	13	2

TABLE OF SCHEDULE OF AIRWAY FARES

From Rangoon to:	*Single Fares* Rs. As. P.	*Fares Return* Rs. As. P.	*Excess Baggage per lb.* Rs. As. P.	*Stat. Mls.*
1. Akyab	95- 0- 0	180- 8- 0	0- 6- 0	308
2. Anisakan	105- 0- 0	199- 8- 0	0- 7- 0	349
3. Anisakan via Mandalay	120- 0- 0	228- 0- 0	0- 8- 0	347+20
4. Bassein	35- 0- 0	66- 8- 0	0- 3- 0	94
5. Bhamo	170- 0- 0	323- 0- 0	0-12- 0	513
6. Gangaw	115- 0- 0	218- 8- 0	0- 8- 0	385
7. Heho	85- 0- 0	161- 8- 0	0- 6- 0	269
8. Henzada	30- 0- 0	57- 0- 0	0- 3- 0	65
9. Kalemyo	140- 0- 0	266- 0- 0	0-10- 0	453
10. Keng Tung	135- 0- 0	256- 8- 0	0-10- 0	388
11. Kyaukpyu	75- 0- 0	142- 8- 0	0- 5- 0	243
12. Kyauktu	105- 0- 0	199- 8- 0	0- 7- 0	335
13. Lanywa	90- 0- 0	171- 0- 0	0- 6- 0	292
14. Lashio	140- 0- 0	266- 0- 0	0-10- 0	430
15. Loikaw	70- 0- 0	133- 0- 0	0- 5- 0	204
16. Magwe	75- 0- 0	142- 8- 0	0- 5- 0	236
17. Mandalay	105- 0- 0	199- 8- 0	0- 7- 0	347
18. Meiktila	85- 0- 0	161- 8- 0	0- 6- 0	273
19. Mergui	115- 0- 0	218- 8- 0	0- 8- 0	351
20. Monywa	110- 0- 0	209- 0- 0	0- 8- 0	358
21. Moulmein	35- 0- 0	66- 8- 0	0- 3- 0	104
22. Myaungmya	31- 0- 0	59- 0- 0	0- 3- 0	85
23. Myitkyina	195- 0- 0	370- 8- 0	0-14- 0	590
24. Pakokku	100- 0- 0	190- 0- 0	0- 7- 0	310
25. Pauk	100- 0- 0	190- 0- 0	0- 7- 0	330
26. Putao	241- 0- 0	457-14- 0	1- 1- 0	730
27. Sandoway	51- 0- 0	96-15- 0	0- 5- 0	159
28. Shwebo	122- 0- 0	231-13- 0	0- 8- 0	298
29. Tavoy	80- 0- 0	152- 0- 0	0- 6- 0	239
30. Thaton	30- 0- 0	57- 0- 0	0- 3- 0	85
31. Toungoo	40- 0- 0	76- 0- 0	0- 3- 0	142

From/To	*Single Fares* Rs. As. P.	*Fares Return* Rs. As. P.	*Excess Baggage per lb.* Rs. As. P.	*Stat. Mls.*
1. Akyab/Kyaukpyu	22- 0- 0	41-13- 0	0- 3- 0	65
2. Bassein/Henzada	25- 0- 0	47- 8- 0	0- 3- 0	73
3. Bassein/Myaungmya	13- 8- 0	25-12- 0	0- 3- 0	20
4. Bhamo/Mandalay	65- 0- 0	123- 8- 0	0- 5- 0	175
5. Bhamo/Myitkyina	26- 0- 0	49- 7- 0	0- 3- 0	79
6. Bhamo/Putao	70- 0- 0	133- 0- 0	0- 6- 0	219
7. Gangaw/Kyauktu	20- 0- 0	38- 0- 0	0- 3- 0	51
8. Gangaw/Pakokku	35- 0- 0	66- 8- 0	0- 3- 0	82
9. Gangaw/Pauk	30- 0- 0	57- 0- 0	0- 3- 0	55
10. Gangaw/Lanywa	35- 0- 0	66- 8- 0	0- 3- 0	93
11. Heho/Loikaw	25- 0- 0	47- 8- 0	0- 3- 0	77
12. Heho/Mandalay	35- 0- 0	66- 8- 0	0- 3- 0	95
13. Heho/Keng Tung	60- 0- 0	114- 0- 0	0- 5- 0	186
14. Heho/Lashio	70- 0- 0	133- 0- 0	0- 6- 0	165
15. Heho/Toungoo	40- 0- 0	76- 0- 0	0- 3- 0	128
16. Kalemyo/Mandalay	48- 0- 0	91- 4- 0	0- 4- 0	155
17. Kalemyo/Monywa	35- 0- 0	66- 8- 0	0- 3- 0	93
18. Kentung/Loikaw	65- 0- 0	123- 8- 0	0- 5- 0	192
19. Kyauktu/Pauk	12- 8- 0	23-12- 0	0- 3- 0	20
20. Lanywa/Mandalay	40- 0- 0	76- 0- 0	0- 3- 0	110
21. Lanywa/Meiktila	25- 0- 0	47- 8- 0	0- 3- 0	70
22. Lanywa/Pakokku	20- 0- 0	38- 0- 0	0- 3- 0	33
23. Lashio/Mandalay	40- 0- 0	76- 0- 0	0- 3- 0	125
24. Loikaw/Mandalay	55- 0- 0	104- 8- 0	0- 4- 0	172
25. Magwe/Mandalay	45- 0- 0	85- 8- 0	0- 3- 0	145
26. Magwe/Meiktila	25- 0- 0	47- 8- 0	0- 3- 0	78
27. Mandalay/Aniskakan	15- 0- 0	28- 8- 0	0- 3- 0	20
28. Mandalay/Meiktila	25- 0- 0	47- 8- 0	0- 3- 0	75
29. Mandalay/Monywa	25- 0- 0	47- 8- 0	0- 3- 0	67
30. Mandalay/Myitkyina	95- 0- 0	180- 8- 0	0- 6- 0	249
31. Mandalay/Shwebo	19- 0- 0	36- 2- 0	0- 3- 0	48
32. Mandalay/Pakokku	30- 0- 0	57- 0- 0	0- 3- 0	80
33. Mandalay/Putao	125- 0- 0	237- 8- 0	0- 8- 0	389
34. Mandalay/Toungoo	65- 0- 0	123- 8- 0	0- 5- 0	205
35. Meiktila/Pakokku	25- 0- 0	47- 8- 0	0- 3- 0	60
36. Meiktila/Toungoo	45- 0- 0	85- 8- 0	0- 3- 0	139
37. Mergui/Moulmein	93- 0- 0	176-11- 0	0- 6- 0	296
38. Mergui/Tavoy	40- 0- 0	76- 0- 0	0- 3- 0	119
39. Moulmein/Tavoy	55- 0- 0	104- 8- 0	0- 4- 0	168
40. Moulmein/Thaton	15- 0- 0	28- 8- 0	0- 3- 0	40
41. Myitkyina/Putao	40- 0- 0	76- 0- 0	0- 3- 0	140
42. Pakokku/Pauk	25- 0- 0	47- 8- 0	0- 3- 0	40
43. Pauk/Lanywa	25- 0- 0	47- 8- 0	0- 3- 0	40

Section IX

COMMUNICATIONS

A. GENERAL.

The development of telecommunications services in Burma has been closely linked with that of India for about a century. Public telegraphic service was opened generally in Burma in 1895, and by 1942 was quite modern in its equipment and adequate in its service. Telephone installation in Burma began in 1888 and was developed into a comprehensive net prior to World War II (WW II), covering rather completely with local and long distance service the bulk of the heavily populated portions of Burma. Wireless development followed land line telegraph and telephone, and a link through India was installed to connect with international nets in early 1936. Telecommunications were almost completely destroyed by denial and enemy action during WW II. Restoration after WW II was rapid, and was accomplished by the British Army Signal Corps, the Civil Affairs Service (Burma) and the returning Civil Government. Equipment from army surplus stocks, some civil type equipment which had been ordered by the Government-in-Exile at Simla, plus such remnants of gear as remained in Burma, were combined to restore some services approximately to pre-WW II standards by the latter part of 1947. With the outbreak of insurrection, damage was as thorough and widespread as that of WW II itself. Services of most types of telecommunications are at a low standard. No land lines are now really secure other than in large population centers and relatively small areas contiguous thereto. Reliance must be basically on wireless until such time as law and order is restored, after which a tremendous rehabilitation task will remain for accomplishment.

B. ESTABLISHMENT OF THE TELECOMMUNICATIONS DEPARTMENT.

1. The term Communications as used herein is limited to the meaning of the word as applied by the Telecommunications Department, and covers telephone, telegraph and wireless. Each is a monopoly of the Government of the Union of Burma and is administered and operated by the Telecommunications Department. All telephone, telegraph and wireless facilities belong to and are under the full control of the government, except for a few amateur licensed radio operators and several commercial organizations, notably the Burmah Oil Company and Burma Corporation among others, who are allowed radio channels for their private communications on payment of royalties.

2. Prior to Independence on January 4, 1948, the telecommunications and the postal services were combined under the Department of Posts and Telegraphs. The Director General of Posts and Telegraphs reported to the Deputy Secretary of the Ministry of Transport, Communications and Labor (now the Ministry of Transport and Communications). Under the director of Posts and Telegraphs, telecommunications were the direct charge of the Chief Engineer, Telecommunications. The postal and telegraph services were closely integrated, and in district towns postal and telegraph offices were combined in single establishments presided over by the local postmasters. The same employees were alternatively engaged in handling mail and in sending, receiving and delivering telegrams.

3. Effective with Independence, the postal and telegraph branches were separated, and the latter raised to the status of the Telecommunications Department, headed by a Director of Telecommunications, who reports directly to the Deputy Secretary of the Ministry of Transport and Communication. The functions of the Telecommunications Department are:

a. The construction, operation and maintenance of inland and foreign telegraph services, including high-speed foreign telegraph service by wireless;

b. construction, operation and maintenance of all local telephone systems and long distance trunk telephone systems throughout Burma;

c. wireless service in Burma;
d. maintenance of a special wireless station to work with ocean shipping in Rangoon;
e. construction and maintenance of telecommunication lines to meet the needs of the Burma Railways, Burma Police and Irrigation Departments;
f. licensing of private telephone and wireless systems and issue of Amateur Wireless Transmitter Licenses and Broadcast Receiver Licenses.

C. ORGANIZATION.

1. The Director of Telecommunications is the Chief Executive of the Department. He has a Personal Assistant for Engineering and a second Personal Assistant for Traffic. The Department is divided into four main Divisions:

a. The Burma Wireless Division with responsibility for all matters connected with wireless in the Department in all of Burma.
b. The South Burma Division (telegraphs), under the direction of the Divisional Engineer (telegraphs), at Rangoon, dealing with engineering, traffic, telegraph and telephone in lower Burma.
c. The North Burma Division (telegraphs), under the direction of the Divisional Engineer (telegraphs), at Maymyo, with similar responsibilities in upper Burma.
d. The Independent Arakan Division, under the direction of the Officer-in-charge, Telecommunications, Akyab, with responsibility for all telecommunications matters in that area, except wireless.

The Director of Telecommunications also has reporting directly to him the Superintendent of each of the following important posts:

(1) Telecommunications Stores, Rangoon
(2) Central Telegraph Office, Rangoon
(3) Central Telegraph Office, Mandalay

Further details of organization, especially with respect to field organization, are shown in Organization Chart. The basic organizational structure and assignment of responsibilities appear to be sound.

D. INTERNATIONAL RELATIONSHIPS.

1. In the field of International and Treaty Agreements with other sovereign powers, Burma has adhered to the Radio and Telegraph Conventions and the High Frequency Agreement formulated at the Atlantic City, New Jersey, U.S.A., meeting in 1947. It is still a party to any international agreement to which it may formerly have adhered as a British Colony or part of the Indian Empire, except in those cases where specific renunciation has been made. No international agreements in the field of telecommunications have been made by Burma since 1947, and it is reported that there is none in the course of negotiation or under consideration at present.

2. The Telecommunications Department assembles all requests from GUB Ministries, Departments and agencies for the assignment of International wavelengths, and makes request to the Secretary General, Union International of Telecommunications at Geneva, Switzerland, for the assignment of such required wavelengths.

E. RELATIONSHIPS WITH GOVERNMENT MINISTRIES, DEPARTMENTS AND AGENCIES.

1. There are a considerable number of activities of the GUB which are so dependent upon wireless and telegraph for the day-to-day conduct of their own work that many such activities execute functions of installation, maintenance, and operations independent, in some measure, of the activities of the Telecommunications Department. These activities include Ministries, Departments and Agencies of the GUB, which have established by agreement with the Telecommunications Department their own working arrangements for varying degrees of assistance in these technical fields. The following list is reasonably complete:

a. The Ministry of Information establishes, maintains, and operates its own wireless broadcasting station in Rangoon. It would presumably handle additionally required stations in like fashion. It procures its own technical staff, and executes the entire function without assistance or advice from the Telecommunications Department.

b. The War Office establishes, maintains, and operates its own wireless net. This is obviously imperative and proper in terms of mobile, military type equipment for field operations. However, the War Office obviously has a considerable volume of routine, "unclassified" administrative business to transact by telegraph and wireless, not related to military operations as such but confined to the overhead establishment, for which no separate net would appear necessary. It appears that the War Office and Telecommunications Department wireless are separately operated with some measure of mutual support.

c. The Inland Waterways Transport Board (IWTB) has had no wireless installation for the control of its fleet. A recent proposal is understood to provide for the installation, maintenance and operation of a wireless net by the IWTB. Wireless control of the IWTB fleet is obviously necessary and desirable.

d. The Burma Railways have need for extensive use of telegraph and wireless. The Telecommunications Department is responsible for the installation and maintenance of land telegraph lines for the Burma Railways, who connect to these lines at their railway stations and install, maintain, and operate their own telegraph instru-

ments. This division of responsibility is said to be satisfactory to both parties. Additionally, however, the Burma Railways install, maintain and operate their own fixed wireless installations for the transaction of overhead business, not train operation, in which the Telecommunications Department has no responsibility.

e. The Director of Civil Aviation (DCA) has an extensive wireless net. The "control" of all non-military aircraft in flight, and the wireless signals to aircraft in flight, approach and landing is the responsibility of the Director of Civil Aviation (DCA). Part of this work in terms of equipment, personnel, and operations is currently handled by contract with International Aeradio, Limited. The DCA has full responsibility in this matter, but is compelled as a prac.ical matter to contract for a part thereof with a foreign company, since he cannot procure an adequate number of trained Burmese. It is the intention of the DCA to take over complete operations as soon as trained personnel are available from Burmese Nationals. This should be done. In this the Telecommunications Department has no responsibility.

f. The Port Commissioners of Rangoon have installed, maintain and operate their own wireless for official communication with ocean going ships entering Rangoon Harbor; in this the Telecommunications Department has no responsibility.

g. The Rangoon Police Force, under the direction of the Police Commissioner, Rangoon, operates a Very High Frequency (VHF) radio telephone net including 25 fixed station, 10 mobile stations, and 1 headquarters control station. This was installed and maintained for some time by the Telecommunications Department, but the latter now has no responsibility with respect to this installation.

2. The complete integration of a supporting means with the Agency responsible for primary work is sound only if it can be afforded. Burma suffers from a great deficiency in telegraph and wireless technicians, competent to deal with installation, maintenance and operation of technical equipment. The Telecommunications Department is itself handicapped to a marked degree by this deficiency. It will take a thoroughly balanced technical training program, utilizing all the means suggested in Section II of this report, plus the most intelligent development and application of a far-sighted "on-the-job" training program, to develop enough really qualified technicians at successive levels from the lowest non-gazetted technical employee to the Divisional Engineers before the Telecommunications Department is properly staffed. This is a challenging task. Until technically trained Burmese are available in truly adequate number, the use of those now available should be "rationed". The application of this principle would dictate a far closer working relationship between the Telecommunications Department and the agencies above cited than generally exists. It is considered that this field is one which should be examined thoroughly, with the primary purpose of economy of trained personnel, and with economy of equipment, supplies, and money an additional purpose. It appears that efficiency may be increased and savings made if the Telecommunications Department generally functioned with these Ministries, Departments, and Agencies to provide technical advice, and perform the work of installation and maintenance, but not operations.

F. FISCAL CONSIDERATIONS.

1. The Telecommunications Department is in reality an active business agency which collects cash daily for many of its services. These cash receipts are turned over to general governmental revenues. The operating expenses and capital outlay of the Telecommunications Department are met by direct appropriation by the Parliament. Under this basic situation, adequate latitude should be allowed the Director of the Telecommunications Department in commitment of funds and payment of bills, as the operation of such a "business" cannot await usual ministerial administration, nor should the daily work of the Ministry of Transport and Communications and the Ministry of Finance and Revenue be impeded by a multiplicity of routine "business" transactions. The existing authority of the Director of the Telecommunications Department appears too limited in this respect. A reasonable increase in the Rs. 2,000 limitation on the authority of the Director of the Telecommunications Department, or the creation of a Board type operation with authorities vested in the Board similar to that of the Union of Burma Airways Board are suggested remedies. In either case, every transaction would be subject to audit by the Auditor General of the GUB.

2. It is reported that rates charged by the Telecommunications Department are established fundamentally on the basis of what the traffic will bear. It is also said that the establishment of rate structures takes political considerations into account. It is to be noted that the Burma Posts and Telegraph Department in pre-WW II years carried its operations at a rather heavy, consistent annual deficit, and that "Telegraphs" which then included the telephone in its accounts produced substantial deficits from its operation. It appears that current rates for some services are surprisingly low, such as the charges for cable messages to certain foreign countries, whereas certain other charges, such as that for telephones in Rangoon, are so high as to be exorbitant—especially in view of the inferior quality of telephone service. It is believed that the considerations on which rates are based, and the rates established, could be reviewed and reset on a more equitable basis, with benefits to the GUB in over-all increased revenue and with equity to the customer and the public. It would appear that the Telecommunications

Department could and should run at a profit under normal conditions, or, as a minimum attainment, at a very greatly reduced deficit.

G. PERSONNEL.

The report of the Telecommunications Enquiry Committee is so replete with serious comments regarding personnel recruitment, training, management, promotion, examination, authority, pay, etc., that no comment here would seem appropriate, apart from suggesting that the recommendations of the Committee, to the extent that they have not already been carried out, should be given the most aggressive and constructive attention. It is interesting to note, moreover, that an actual majority of that Committee's recommendations are directed to the basic problem of personnel, and to almost all subordinate fields of personnel implementation. If the findings of that Committee be correct, little of a constructive nature can be accomplished by the Telecommunications Department until corrective measures shall have been taken.

H. SUPPLY OF EQUIPMENT.

1. The Telecommunications services are entirely dependent for almost all kinds of equipment, spare-parts, and other supplies on foreign sources. Equipment in use in the telephone and telegraph systems is largely ex-military, frequently not well adapted for civil use. Nearly all equipment needs early replacement. The situation in wireless is somewhat better. Burma is self-sufficient only in respect to the crudest raw materials, such as general building materials. Everything else must be imported. Practically all of the telephone equipment has been obtained in the past from the United Kingdom, from Standard, General Electric, or Siemens-Halske. Much of the wireless equipment is from the United States from Radio Corporation of America, and more is now on order or has recently been delivered from this source.

I. EXISTING FACILITIES.

The Telecommunications service of telegraph and long distance telephones have been hard hit by insurgency. Any facilities dependent upon land lines, the taking of which is at once an act of sabotage and the production of profit, is peculiarly vulnerable under insurgency. Wireless is patently more secure. Each is discussed in the following sections.

J. LAND LINE TELEPHONES.

1. Prior to WW II the telephone land line net had been extended to give an excellent coverage of Burma as a whole, as illustrated in the chart enclosed. The system was well equipped with long distance lines, generally of iron, a few of copper. The telephone repeaters, first introduced in 1922, were being replaced by the Carrier System starting in 1940. The demand for telephone service was relatively great, and was expanding at a high rate; business men as well as individuals were becoming increasingly conscious of the great advantages of the telephone. The whole of the trunk telephone network was destroyed during the Japanese occupation, yet by 1947 a more extensive trunk telephone network than that which existed in 1941 had been reconstructed. A modern trunk telephone line especially designed for Carrier System operation had been constructed along the road from Rangoon to Mandalay; Mandalay to India; Akyab to India; and Rangoon to Moulmein. The Rangoon-Mandalay line carried four first grade trunk circuits. A three-channel Carrier Telephone System could be operated on each pair of wires giving a possible total of 16 circuits from Rangoon to Mandalay. The trunk circuit from Rangoon to Bassein through the difficult Delta Area was restored together with those between Rangoon and Martaban; Rangoon-Prome-Yenangyaung-Chauk-Myingyan-Mandalay-Monywa; Mandalay-Shwebo; Mandalay-Lashio; Meiktila-Kalaw-Taunggyi, and Akyab-Rathendaung-Buthidaung. This extensive network was beginning to work efficiently when the wanton destruction of lines by insurgents and dacoits put a stop to all development and threw the country back approximately to the state it was in at the end of the Japanese occupation.

2. Trunk line telephone service is currently made impossible by insurgency. The latest information regarding long distance lines which are available gives only the following:

Kyaukse-Mandalay-Maymyo-Hsipaw-Lashio
Mandalay-Sagaing
Meiktila-Thazi-Kyawbye-Yamethin
Pegu-Nyaunglebin-Pyu-Toungoo
Rangoon-Pegu
Rangoon-Prome
Rangoon-Twante

No extra charge is now made for trunk calls. However, it is always difficult and frequently impossible to put through calls on these lines.

3. It is practicable of course to maintain better local than long distance service for telephones. Even here service is not really good, as most switchboards are ex-Army equipment, with spare-parts difficult to obtain, sometimes unobtainable. In many instances the "make" of the switchboard is not known. Mandalay has a local system of approximately 300 lines operated on a central battery system. Moulmein has about 100 lines. The other larger exchanges consist usually of a single fifty-line switchboard. In the smaller towns very few private persons or businesses have telephones, and the service primarily connects officials and government departments. Nearly all of the telephone instruments have been put on a single line. Each of the following named towns oper-

ate on local battery systems, with the number of lines shown where these data are available:

Akyab
Aungban, 8 lines
Bassein
Bhamo, 14 lines
Buthidaung
Chauk, 6 lines (not including BOC system)
Hsipaw, 39 lines
Kalaw, 12 lines
Kalewa, 12 lines
Katha, 16 lines
Kyaukse, 24 lines
Kyaukme, 32 lines
Lashio, 39 lines
Loilem, 10 lines
Magwe, 2 lines
Maymyo, 67 lines
Shwebo, 27 lines
Taunggyi, 34 lines
Tharrawaddy
Thaton
Meiktila, 68 lines
Mergui
Minbu, 13 lines
Monywa, 17 lines
Myingyan, 31 lines
Myitkyina, 14 lines
Myitnge, 3 lines
Nyaunglebin, 8 lines
Nyaungoo, 4 lines
Pakokku, 9 lines
Pegu
Prome
Pyawbwe, 11 lines
Pyinmana, 14 lines
Pyu, 5 lines
Sagaing, 28 lines
Thazi, 7 lines
Toungoo, 25 lines
Yamethin, 17 lines
Yenangyaung, 44 lines

Frequently the office and residence of the same official are on a single line. The total number of lines in the public telephone system, including Rangoon, is about 3,500. In addition, the Burma Airways, some Army installations, and several large commercial companies have systems of their own.

4. *a.* Rangoon is the only city in Burma with more than a single telephone exchange. The number of telephone connections in Rangoon is:

Exchange	*July* 1951
South	1,029
West	276
Regent	227
Seikgyi	24
Central	219
North	371
Mingaladon	60
Insein	39
	2,245

The South Exchange consists of 20 position switchboards worked under the central battery, multiple system. Each board has 75 lines, or a total of 1,500 possible lines, but after allowing for junctions there are only 1,100 numbers available on this exchange. The West Exchange, recently established as an auxiliary to the South Exchange, with numbers running from 1100 to 1420, has four identical boards similarly operated. Regent, a small 300-line magneto exchange, and Central, a 400-line exchange, have also been recently established as auxiliaries to South. The North Exchange serves the northern residential section of Rangoon, while Seikgyi, Mingaladon and Insein serve certain of the suburbs. Practically all telephone lines are single-party, although a few double-party lines have been established recently because of the lack of switchboard capacity. There are now about 50 private switchboards in operation in Rangoon, compared with about 100 before the war.

b. The telephone system of Rangoon was most thoroughly studied by the Telecommunications Enquiry Committee. Their report, submitted to the GUB on 17th June, 1949, was caustic, charging many operating inefficiencies as well as citing inadequate and outmoded equipment. Because of the alleged inefficiences of the present telephone system, particularly on the part of telephone operators and supervisory personnel; the fact that the existing equipment is generally old and unsuitable; and finally the really difficult problem in Rangoon of language and pronunciation, the Telecommunications Enquiry Committees recommended that an automatic telephone system be installed in Rangoon. This had been previously recommended by Mr. C. M. Scott, in February, 1947, then Advisor to the Telecommunications Department. The Telecommunications Department has accepted this recommendation in principle, and during January, 1951, three British engineers visited Rangoon for the purpose of surveying the existing facilities and designing a new automatic telephone system. No specific decision has been reached in this matter by the GUB, and no appropriation has been made for the installation of such a system. The facts seem well established that the existing Rangoon telephone equipment will require replacement at a reasonably early date. An automatic exchange would overcome many basic management difficulties. However, such a system is complex and delicate, and in this climate would require air conditioning of the automatic exchange equipment. Highly skilled technicians would be required for regular maintenance. The availability of all elements of maintenance requirements, including thoroughly trained technicians for around-the-clock duty is an inescapable prerequisite. The approval of this project is recommended.

5. Maintenance of the telephone system involves the elements of equipment and personnel. Both problems have been described in considerable measure in preceding paragraphs. The quality of maintenance, where adverse conditions permit operations at all, is below an acceptable standard. There appears little basis to expect really satisfactory maintenance until the personnel problem shall have been solved, in substantial part at least, and until the basic equipment now in use shall have been largely replaced.

6. A few miscellaneous items seem pertinent. Traffic data are few; it is quite necessary to keep statistics essential to estimating business trends accurately. There are no picture transmission facilities. There are no special telephone links available. There are no radio-telephone services available for public use within Burma.

7. It is apparent that the land line telephone system is all but prostrate. Land lines are generally destroyed. Equipment in use in local telephone systems is largely beyond economical restoration. The problem in reality is one of rebuilding, not rehabilitation. The determination or selection of the system to be used in the future for long distance transmission should be reached after analysis and evaluation of several possibilities. The Carrier System is a proven workable system, which uses land lines costly to install and maintain. Less expensive, and thoroughly

proven in other countries, is the Very High Frequency (VHF) system, which substitutes wireless for land lines. VHF is reliable, workable, and satisfactory in use. A still more recent development is micro-wave transmission, or Ultra High Frequency (UHF) wireless. In micro-wave transmission, messages are converted into electronic impulses which are beamed to their destination, usually through a series of relay towers 25 to 50 miles apart. Micro-wave systems are versatile: a single channel can carry up to 2500 messages at one time; messages may be oral or code. American industry is turning to UHF as a solution to the cost of installing and maintaining telephone, telegraph and teletype lines. A thorough study should be made of the applicability of UHF to the solution of transmission problems, both telephone and telegraph, before resorting to a full-scale renewal of the type of land-line system used before WW II.

8. Under these circumstances it would seem clear that rebuilding, when done—and it should be done as soon as possible—should involve:

a. Installation of modern equipment in local exchanges. For example, the Rangoon telephone system should be reestablished as an automatic system;

b. The rehabilitation of the principal land-lines for long distance transmission, within the limits of practical economy, at the earliest practicable time to serve important present and "near-term" needs only. This investment of capital funds should be carefully limited, pending final determination as to whether the system itself will be changed to VHF or UHF wireless transmission.

c. Specific determination of the type transmission system for long distance service that will be used for the future, followed by implementation of that decision.

This VHF or UHF type of installation is certain to provide better service than the older types, and will prove less costly in the long run.

9. Every reason is seen to anticipate a profit to GUB from telephone operation provided the personnel problems cited above can be solved, and the telephone system reconstituted. The volume of business will increase, perhaps double, as soon as proper service can be rendered to subscribers. Thereafter, the demand for telephone service will continue to increase many fold. The market is there, and only awaits a system of merit to provide the service and capitalize on potential business. It is important to the economic life of Burma that this be done.

K. LAND LINE TELEGRAPH.

1. Prior to WW II there was an extensive network of telegraph lines throughout Burma, including the following:

Rangoon-Mandalay (five lines) extended to India
Rangoon-Moulmein-Tavoy-Mergui
Rangoon-Bassein
Prome-Sandoway-Akyab, extended to India
Mandalay-Bhamo-Myitkyina
Mandalay-Lashio
Meiktila-Taunggyi-Keng Tung

There were in the country a total of 656 telegraph offices, about half of which were railway telegraph offices, connected by 8,373 miles of line and 33,281 miles of wire. Volume of business handled had attained a large figure. There were two land lines to India, via Akyab and Chittagong and via Tamu and Manipur, respectively. Lines from Myitkyina to Putao, from Bhamo into China, and from Tavoy into Siam, had already been abandoned in earlier times as uneconomic. Despite the existence of two land lines to India, the bulk of traffic between Burma and India was already being transmitted by wireless from Mingaladon to Madras, prior to the war. Like the telephone system, the telegraphic network was destroyed almost in its entirety during the Japanese occupation. By the end of 1947, however, the network had been largely restored, although certain lines, notably that from Prome to Akyab, connecting with one of the lines into India, were abandoned. The line to India via Tamu and Manipur was restored.

2. Most of these lines have again been destroyed by the insurrection, so that there are now no surface telegraphic communications tying Rangoon with any of the district towns. It is not known to what extent lines and poles have actually been destroyed or removed, although it is believed that more of the telegraph wires, which were of iron, remain in place than the telephone wires.

3. Both because of the frequent destruction of surface telegraph lines by war and insurgency, and because of the difficulty and expense of maintaining such lines even in normal times, the Telecommunications Department has decided as a general policy to rely increasingly upon wireless telegraphy. It has not been decided to abandon land lines altogether, however, and efforts are being made to maintain such lines as are only slightly damaged, and certain land lines are being rehabilitated or extended. Prior to the war railway stations also served as telegraph stations for the receipt and delivery of public messages. It has recently been decided that the railway telegraph facilities should again handle public messages, and connections between the railway and telecommunications telegraph lines have recently been made in 11 principal towns to serve this purpose.

4. The Burma Railways possess their own telegraph lines and trains are normally dispatched by telegraph or by tablet machines. The railway telegraph wires normally parallel all operating railway lines. As they are fre-

quently broken by insurgent action, however, the railway has an auxiliary radio communications of its own, with sending and receiving stations at Rangoon, Mandalay, Toungoo, Thazi and Katha for use in general administration rather than dispatch of trains.

5. As is the case with the land line telephone system, the problem in telegraph is less one of rehabilitation than that of planning a new system. Effort is being made to restore lines on the best and most practicable basis with the means available. However, the destruction of the system during WW II, its rehabilitation, and its second destruction in the insurrection has left a problem of extreme difficulty, with constantly diminishing means with which to make repairs. Under these circumstances, it would appear to be the part of wisdom to extend the present system as promptly as may be to connect only the principal commercial and governmental centers, restricting investment of capital reasonably, consistent with these present and near-term actual needs. It may be possible to expand the existing W/T net to such an extent that it may substitute adequately for a reasonable time for land-line telegraph. In any event the VHF or UHF system appears entirely feasible for application in Burma and should be fully investigated, and detailed, accurate cost estimates and time schedule of expenditures prepared for use as the solution to the problem of the long-range telegraph system. It is considered that this system will prove better, less costly, and more reliable than conventional construction.

L. WIRELESS.

1. Prior to WW II, the Posts and Telegraph Department had a Wireless Branch which was responsible for the very limited activity in wireless in Burma. The most important link then operated was wireless telegraph from Rangoon to Madras, India, with onward connections; wireless telephone between the same points was on an experimental basis. The services of the wireless branch included wireless activity for aeronautics, ocean shipping, meteorology, commercial telephone and telegraph outside Burma, and a limited amount of inland traffic. The ten most important stations of the total of 13 were:

Aeronautical Station, Akyab
Shipping W/T Station, Bassein
Shipping W/R Station, Diamond Island
Transmitting Station, Mingaladon
Direction Finding Station, Mingaladon
Shipping W/R Station, Monkey Point
Receiving Station, Mingaladon
Meteorological Station, Sandoway
Aeronautical Station, Tavoy
Wireless Station for Light Houses—
Meteorology and Aeronautical—
at Victoria Point

These stations handled a large volume of business totaling 523,418 messages in the fiscal year 1939-40, broken down as follows:

	Messages
Aeronautical	90,592
Shipping, Reutorian Press, British Official Wireless Press, and other miscellaneous foreign traffic	14,840
Messages between Madras and Rangoon	396,640
Inland traffic by wireless	21,346

Broadcasting was inaugurated in 1938, a Phillips 10 KW Broadcast transmitter was installed and initiated operation in 1940, and a second transmitter for the Rangoon City Area was being installed. Radio receiving sets were licensed by the Wireless Branch, 6321 licenses being issued in Fiscal Year 1939-40 on an annual renewal basis. Practically all equipment of the Wireless Branch was destroyed during WW II. In addition to the above, the Colombo Circuit, Burma's normal link with the outside world, was operated under license by the Cable & Wireless Company, Limited.

2. The present wireless system of Burma is a function of the Telecommunications Department, apart from the exceptions listed in Section E, and consists of the following:

a. There is a relatively extensive wireless telegraph system in Burma, and practically all inter-city telegraphic communications are now sent by wireless. A chart graphically portrays this system as it currently exists. The Telecommunications Department is now working on a plan for the extension and improvement of wireless telegraph service to the point where every township will ultimately be linked with a district headquarters, and through such headquarters to one of three major zone stations in Rangoon, Mandalay and Akyab. To initiate this plan of extension, 64 transmitter-receivers have recently been ordered from Radio Corporation of America, at an estimated cost of $120,000, although most of these units will be required as replacements for the poorest of the presently installed sets. Inasmuch as the land-lines for telephone and telegraph are so completely disrupted, the W/T net constitutes the only net actually operating within Burma. This net accordingly is of the highest importance. The extension of this net to include all Division and District headquarters without delay would appear to be of the utmost significance. Its further extension to include at least the principal Townships should follow promptly. Without the capacity to communicate, neither information nor instructions may flow; a tool of Government, one of the most basic, is lost. It would appear beyond all question that this project should be prosecuted with the utmost vigor.

b. There is no wireless telephone within Burma. The Telecommunications Department has made definite plans for the installation of a VHF channel with two intermediate relay stations between Rangoon and Bassein as an experimental test. Necessary equipment has been procured and is being installed. The services of a skilled technician are now under procurement. This test should

prove quite successful, as the topography between Bassein and Rangoon is favorable and the method itself is known to be practicable. The test should be expedited, and all pertinent statistical data with respect to installed cost, operating cost, maintenance difficulties, utilization, revenue production, etc., should be maintained accurately and in a form to facilitate analysis and evaluation of the system. The results of this test should then be compared most critically with the estimates pertaining to the use of the micro-wave transmission system. This will permit decision as to which system appears most adequate and economical, a decision of major importance.

c. Foreign wireless telegraph connections are maintained by two circuits, from Rangoon to Colombo and Madras, respectively. The Colombo circuit was formerly operated by the Cable and Wireless, Ltd., but was taken over by the Telecommunications Department as of June 10, 1946. The Madras Circuit, interrupted during the war, was restored on June 24, 1946. Transmission over these circuits is at high-speed, with 250 words per minute practicable under favorable conditions. The station handles about 96,000 outgoing and 87,000 incoming messages per year, which produces something more than Rs. 5 lakhs revenue per annum.

d. There is no wireless telephone connection from Burma to other parts of the world. This is regarded as a serious deficiency in the communications system, and is one of the problems confronting the Telecommunications Department for early solution. The most obvious and feasible, as well as the commercially most valuable, connection is through India. A connection eastward through Manila should follow as next in order of importance. This is a service of substantial commercial importance, and would appear also to have value in official use by the GUB.

3. There is only one wireless broadcasting station in Burma. It is located at Mingaladon, is government owned, and operates on long wave. It is operated by the Ministry of Information. Consideration is being given to the establishment of a broadcasting station at Mandalay. There are approximately 10,000 registered radio receiving sets in Burma, with a like number estimated as unregistered.

M. CABLES.

There are no sub-marine cable transmission lines, nor did any exist prior to WW II.

N. BURMESE LANGUAGE CODE.

1. Code telecommunications have heretofore been in International Morse. Since many Burmese do not know English, and it is desired to make telegraph more readily available to them, experimentation has been taking place with a Burmese language telegraph code. Development of the code itself required more than a year. Its experimental use was authorized in 1951 for telegraph messages between Rangoon and Bassein, and has later been extended for use between Rangoon and Akyab, Moulmein, Mandalay, and Toungoo. If this service is successful, it is expected that Burmese language telegraphy will be introduced for general use within Burma.

O. CONCLUSION AND RECOMMENDATIONS.

1. The Telecommunications Department has been hit harder by WW II, the insurrection, and the Burmanization policy than most GUB Departments. Its land lines continue to be interrupted constantly, without apparent real hope of early relief. Its telephone equipment is approaching the end of its useful life, and has already reached a stage making maintenance difficult, in some cases impracticable. Some wireless equipment is new and modern; some is obsolete and extremely difficult to maintain. Problems in personnel training and management are of great complexity and magnitude. The W/T net provides positive communication to about 30 important centers only. There is no telephone communication of significance, other than local within the main population centers. Communication outside of Burma by telegraph is satisfactory, by telephone is non-existent. Communications fall far short of the adequacy or flexibility which existed pre-WW II. Neither government, industry, nor commerce can function with the desirable effectiveness under such communication deficiencies. It would seem imperative, therefore, that top priority be given and heroic effort be made to establish adequate telecommunications. The following recommendations are presented in order of priority and cover the points of greatest immediacy. It is recommended:

a. That the expansion of the internal wireless telegraph (W/T) net be expedited to include all Division and District Headquarters; and, thereafter, that it be further extended to include at least the more important Township Headquarters.

b. That a most carefully considered training program be established for telecommunications personnel in all grades, comprehensive in scope, theoretical and "on-the-job", with the utmost in terms of leadership and proper incentive for personnel to participate.

c. That the best solution to the problem of restoring long distance telephone and telegraph communication be studied thoroughly; pending this decision, that all practicable measures to rehabilitate existing land telephone and telegraph lines be emphasized, within the limits of practical economy, to serve important present and near-term needs only; that, concurrently, the experimental application of VHF be vigorously expedited, with the compilation of accurate statistical data to permit a correct evaluation in terms of cost of purchase, installation, maintenance,

operation, reliability, etc.; that the most accurate and practicable estimate of the cost of UHF to serve internal long distance telephone and telegraph needs be made; and, finally, a specific determination be then made based on the above data as to the most reliable and practicable system for adoption and future use.

d. That the actual deficiencies in personnel procurement, administration and management which may yet remain from among the citations in the report of the Telecommunications Enquiry Committee be given vigorous action for correction.

e. That the Rangoon telephone system be replaced by the installation of an automatic dial system.

f. That International Telephone service be established, initially through India and subsequently through the Philippine Islands.

g. That the status of the Telecommunications Department as a "business" operating within the procedures of the GUB be re-examined from a fiscal and procedural view-point, to assure that the Director of the Telecommunications Department is given adequate latitude in the obligation and payment of funds to manage the administration of the Department expeditiously and in a business-like manner, and at the same time provide fully adequate protection to the GUB.

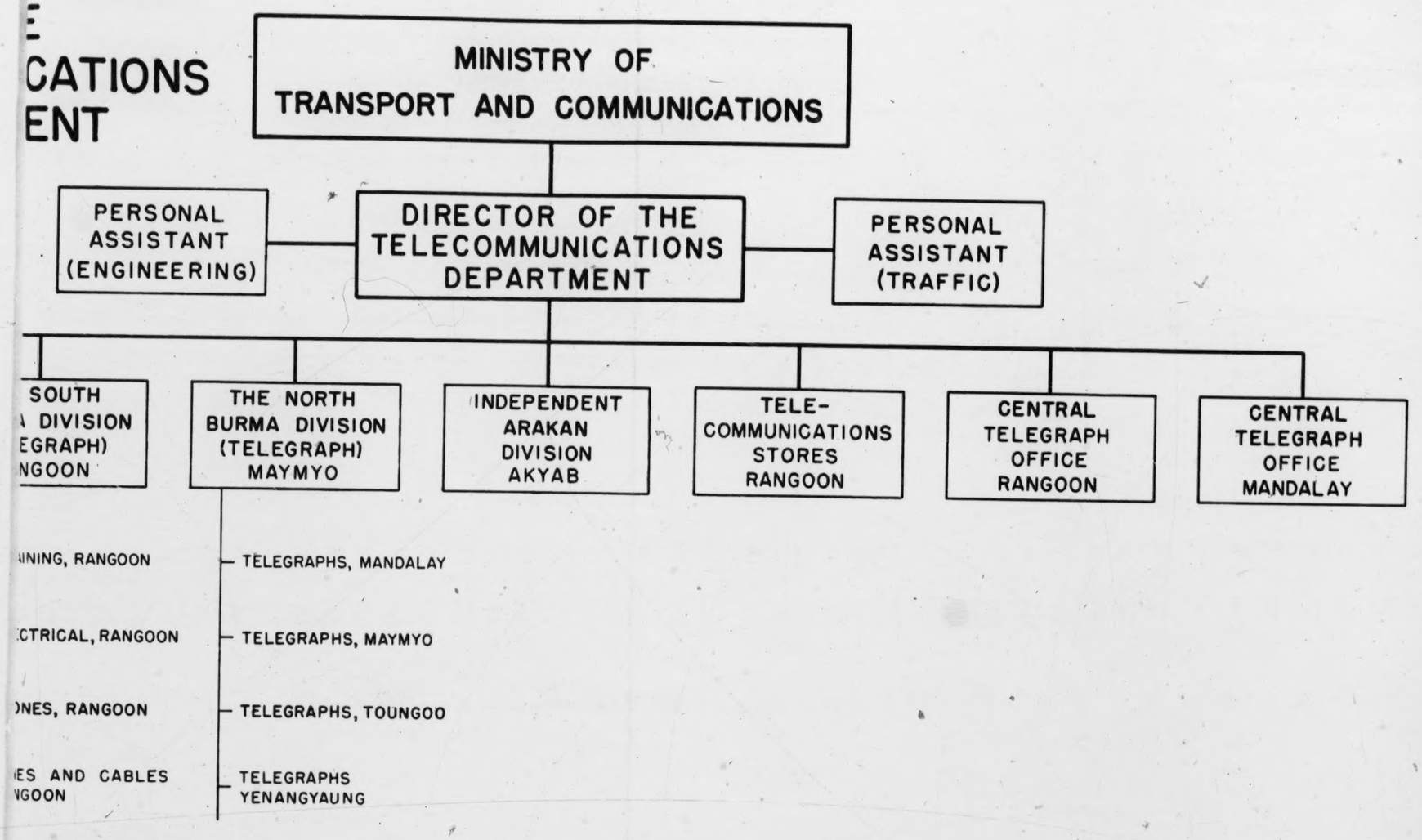
h. That the Telecommunications Department be made responsible for installation and maintenance, but not operation, of wireless installations of the GUB (with the possible exception of the installations controlling aircraft).

i. That the basis on which rates for Telecommunications Department services are based be re-examined, and that charges for services be re-established on a sound and workable basis.

ORGANIZATION CHART OF THE TELECOMMUNICATIONS DEPARTMENT

- MINISTRY TRANSPORT AND CO
  - DIRECTOR O TELECOMMUNI DEPARTM
    - PERSONAL ASSISTANT (ENGINEERING)
    - BURMA WIRELESS DIVISION RANGOON
      - MONKEY POINT WIRELESS TRANSMITTING STATION RANGOON
      - TRANSMITTING STATION RANGOON
      - RECEIVING STATION RANGOON
      - WIRELESS STATION MANDALAY
      - WIRELESS STATION AKYAB
    - THE SOUTH BURMA DIVISION (TELEGRAPH) RANGOON
      - TRAINING, RANGOON
      - ELECTRICAL, RANGOON
      - PHONES, RANGOON
      - LINES AND CABLES RANGOON
      - TELEGRAPHS, RANGOON
      - TELEGRAPHS, PROME
      - TELEGRAPHS, BASSEIN
      - TELEGRAPHS, MOULMEIN
    - THE NORTH BURMA DIVISION (TELEGRAPH) MAYMYO
      - TELEGRAPHS, MANDALAY
      - TELEGRAPHS, MAYMYO
      - TELEGRAPHS, TOUNGOO
      - TELEGRAPHS YENANGYAUNG
    - INDEPENDE ARAKAN DIVISION AKYAB

CHART
E
CATIONS
ENT



BURMA

TELEPHONE NET-WORK
PRE WORLD WAR II

REFERENCES.

1. Departmental Telephone System. ---●
2. Public Call Offices. ----------○
3. Non Departmental Exchange System. -▲
4. Copper Trunk Line --------- ——
5. Iron Trunk Line ---------- ——
6. Wireless Trunk ---------- — —
7. Private Cox Exchange System ----○
8. Proposed Copper Trunk ..... ----

Miles 20 0 20 40 60 80 100 Miles

NAGA HILLS
MYITKYINA
CHINDWIN
UPPER CHINDWIN
BHAMO
KATHA
SHWEBO
LOWER CHINDWIN
NORTHERN SHAN STATES
CHIN HILLS
INDIA

Kamaing
Myitkyina
Mogaung
Sima
Monyin
Sinbo
Upper Defile
Banmauk
Nabar
Indaw
Mada
Shwegu
Sinlumkaba
Bhamo
Kath
Pinlebu
Wuntho
Inywa
Kawlin
Tigyaing
Pangkham
Kyu-kok
Muse
Namkham.
Hosi
Kutkai
Hsenwi
Mawlaik
Kalewa
Tiddim
Haka
Ye-U
Tindeinyan
Segyi
Shwebo
Kani
Budalin
Alon
Madaya
Momeik
Namhsan
Thabeikyin
Kyaukmyaung
Kyaukme
Hsipaw
Pangkhai
Namlu
Lashio
Namyao

CHINDWIN
Monyin
Sinbo
Upper Defile
BHAMO
Banmauk
Moda
Naba
Indaw
Shwegu
Sinlumkaba
Bhamo
Pinlebu
KATHA
Katha
Kyu-kok
Muse
Wuntho
Inywa
Pangkham
Kawlin
Tigyaing
Namkham
Hosi
Kutkai
UPPER
Mawlaik
Tiddim
Kalewa
SHWEBO
NORTHERN SHAN STATES
Hsenwi
Pangkhai
Namtu
Lashio
Momeik
Namhsan
Thabeikyin
Namyao
Ye-u
Tindeinyan
Kyaukmyaung
Kyaukme
Hsipaw
Naka
CHIN HILLS
Segyi
Shwebo
Kani
Budalin
LOWER
Alon
CHINDWIN
Monywa
Madaya
Sagaing
Maymyo
Myinmu
MANDALAY
TO INDIA
ARAKAN HILL TRACTS
Tilin
PAKOKKU
Myaing
Kyaukse
Pauk
Pakokku
Myingyan
Myittha
Kanpetlet
Taungtha
Saw
Nyaungoo
Singu
Mahlaing
MEIKTILA
Chauk
Meiktila
Thazi
Aungban
Kalaw
SOUTHERN SHAN STATES
Sale
Pakhangyi
Sinbyugyun
Kyaukye
Yenangyaung
Sidoktaya
MINBU
B.O.C.
I.B.P.
B.O.C.
Pwinbyu
Minbu
AKYAB
Akyab
Ngape
Magwe
KYAUKPYU
Minhla
Taungdwingyi
MAGWE
Megyaungye
YAMETHIN
Sinbaungwe
THAYATMYO
Kyaukpyu
Mindon
Thayetmyo
Allanmyo
SANDOWAY
Ramree
Mae
Kama
KARENNI
Yedashe
Thandaung
Taungup
Taungoo
Mawchi
PROME
Prome
Lanmadaw
(PROME)
Shwedaung
Zeyawaddy
TOUNGOO
Ye
Kanbauk
Kyaukmedaung
TAVOY
TAVOY
Paungde
Pyu
Nattalin
Zigon
Kyaukkyi
Kyauktaga
Gyobingauk
Okpo
Peinzalok
Kyeintali
Minhla
Nyanglebin
Shwegyin
SALWEEN
HENZADA
Satthwa
Sitkwin
PEGU
Palauk
Palaw
Letpadan
Gwa
Henzada
Tharrawaddy
Mokpalin Quarries
Zalun
Thonze
Mokpalin
Milaungchaung
Yegyi
Okkan
Pegu
Kyaikto
Ngathaingyaung
Taikkyi
Thanatpin
Kyonpyaw
Danubyu
Kangyidaung
Wanet Chaung
THATON
Hlaingbwe
Thabaung
Kyaunggon
Onhne
BASSEIN
Einme
INSEIN
Yandoon
Thakata
THATON
Pa-an
Thayetkon
Pantanaw
Bassein
Ma-ubin
RANGOON
Thongwa
MERGUI
Myaungmya
Syriam
Ngaputaw
Wakema
HANTHAWADDY
Thingannyinaung
Myawaddy
Martaban
Kyaiklat
Moulmein
Kyonmagyi
Dedaye
Mupun
Moulmeingyun
Mudon
Labutta
Pyapon
Bogale
PYAPON
AMHERST
TO MADRAS
Ye
Ye Ryl. Stn.

BURMA
TELECOMMUNICATIONS
W/T LINKS
92°
93°
94°
95°
96°
97°
98°
99°
100°
101°
28°
27°
26°
25°
24°
23°
22°
21°
20°
PUTAO
Putao (Fort Hertz)
Kumjawng Pass
Tari Wang
Hkaoling
Mogaung
Rang Seng Triangle
Hukawng Valley
Tsumgaw
Hpimaw
Singkaling Hkamti
Tamanthi
Kamaing
MYITKYINA
Myitkyina
Sadon
Sima
HOMALIN
Banmauk
Maulu
PAUNGBYIN
Paungbyin
KATHA
Katha
BHAMO
Bhamo
SALWEEN
Nam Kan
MAWLAIK
Mawlaik
KALEWA
Kalewa
Falam
Ft. White
Kalemyo
Tiddim
Pinlebu
Tagaung
Kunlong
Namtu
Lashio
MOGOK
Mogok
Shwebo
Sagaing
Gokteik
Hsipaw
WA STATES
Mong Hsaw
Takaw
Mongyai
Mongma
Mongyu
Maymyo
MANDALAY
Meiktila
Kyaukse
Monywa
GANGAW
CHIN HILLS
Paleo
Tiltin
Yesagyo
Myaing
Pakokku
PAKOKKU
PALETWA
Paletwa
Daletme
Ramu
KANPETLET
Mount Victoria
Saw
Pagan
Mahlaing
CHAUK
Yenangyaung
Yamethin
Taungtha
Myittha
Sagu
Minbu
MINBYA
Minbya
MYEBON
Myebon
AKYAB
Akyab
Sidoktaya
Salin
Pauk
Sale
Thazi
Taunggyi
Kalaw
Loilem
Lawksawk
Mong Nawng
Mong Kung
Mong Hsang
Mong Hsat
Mong Mao
Mong Yawng
Mong Pan
Mong Nai
Loi-ang
Kyaukme
Hsipaw
Nam Tu
Kehsi Mansam
Mong Song
Mong Tung
Mong Lwe
Loimwe
Mong Kyawt
Maungdaw
Buthidaung
Kyauktaw
Myohaung
Donbaik
Ngakyedauk Pass
Tunnel
Mong Ping
Mong Ko
Mong Hkam
Mong Hkawng
Mong Hpayak
Mong Hsu
Mong Hsaung
Mong Hsawng
Mong Hsu
Mong Hsaung
Mong Hsawng
Mong Hsu
Mong Hsaung
Mong Hsawng

TELECOMMUNICATIONS W/T LINKS

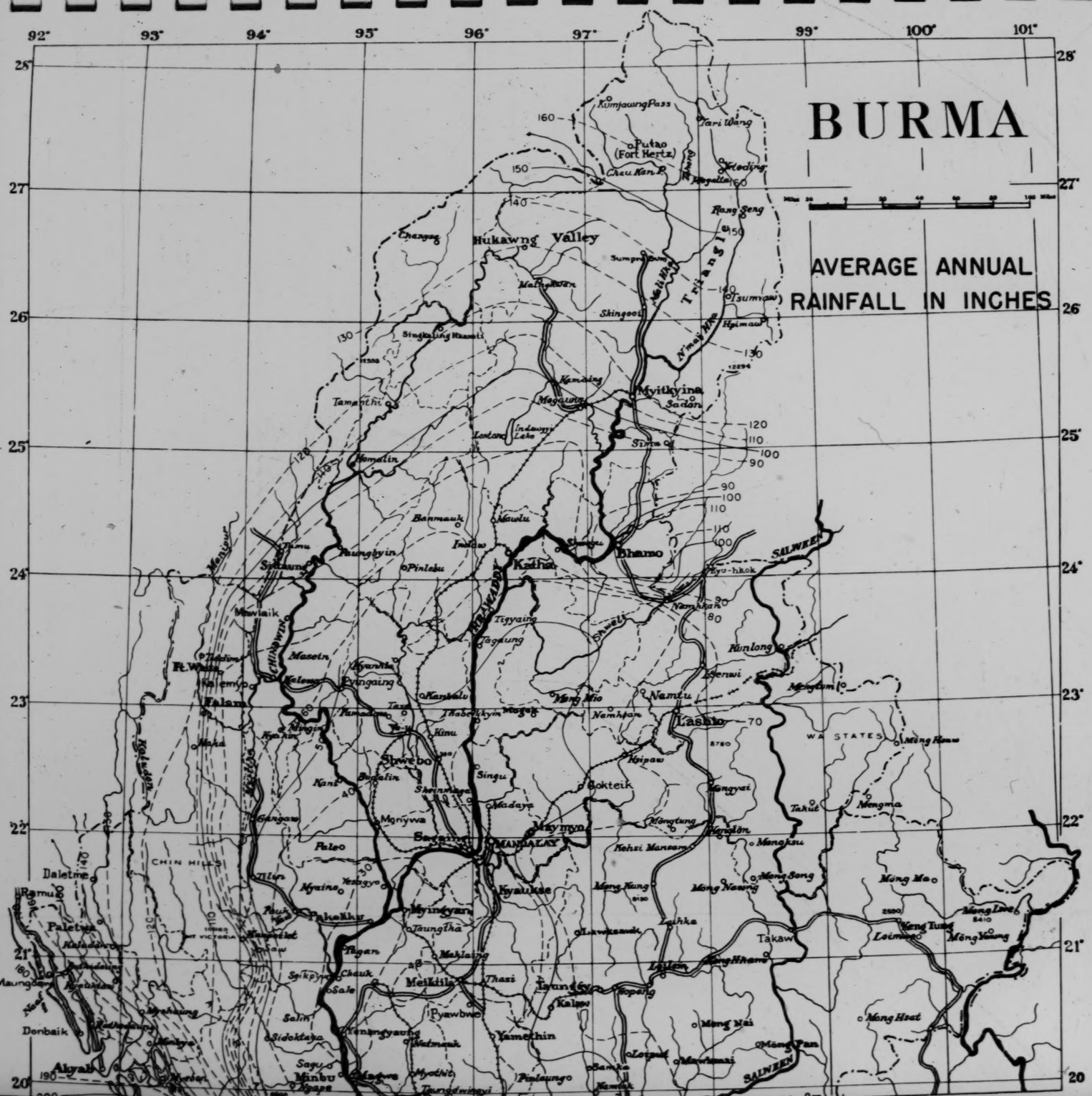
JANUARY 1952

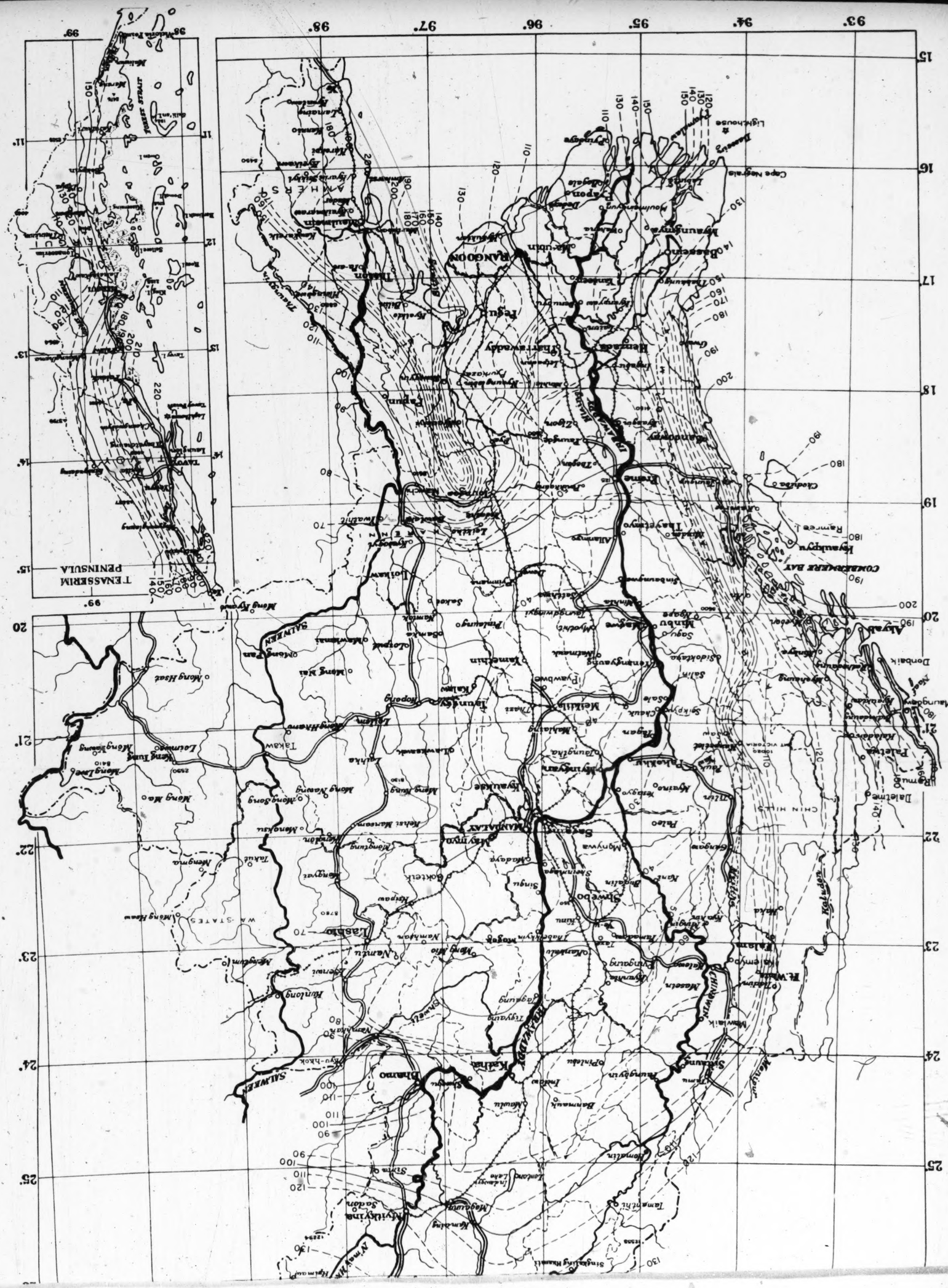
Not in operation. In hands of insurgents.

PALETWA
KYAUKTAW
MYOHAUNG
MINBYA
MYEBON
CHEDUBA
MAWCHI MINES

To Madras
To Colombo
To Ships

TENASSERIM PENINSULA


BURMA
AVERAGE ANNUAL
RAINFALL IN INCHES
92°
93°
94°
95°
96°
97°
98°
99°
100°
101°
28°
27°
26°
25°
24°
23°
22°
21°
20°
Kumjaung Pass
Tari Wang
Putao
(Fort Hertz)
Chau Kan R.
Hkading
Rang Seng
Hukawng Valley
Changpa
Singkaling Hkamti
Tamanthi
Homalin
Lahe
Indaw
Lake
Banmauk
Maulu
Pinlebu
Kachin
Bhamo
Myitkyina
Sadon
Sima
Hpimaw
Sumprabum
Shingooli
Mali Hka
Nmai Hka
Triangle
Kamaing
Mogaung
Tigyaing
Tagaung
Shwegu
Kyu-hkok
Salween
Nam Tabet
Kunlong
Lenwai
Mongtum
Namtu
Namhpat
Lashio
Mong Mao
Hsipaw
Mongyai
Takuk
Mengma
Mong Hawa
Wa States
Mongsu
Mong Song
Mong Nawng
Mong Ma
Mong Lwe
Meng Tung
Meng Yawng
Takaw
Loimwe
Lwelem
Mong Hkam
Mong Hsat
Mong Pan
Mong Kyawt
Kokteik
Kohsi Mansam
Mongtung
Mongkan
Mandalay
Sagaing
Madaya
Singu
Shwebo
Monywa
Kanbalu
Kani
Gangaw
Pauk
Pakokku
Yenangyaung
Kyaukse
Myingyan
Taungtha
Meiktila
Thazi
Wundwin
Yamethin
Pyawbwe
Kalaw
Loilem
Mopaing
Lawksawk
Loilen
Chin Hills
Falam
Haka
Kalemyo
Kalewa
Myaing
Kanbalu
Tabayin
Mingin
Kyaukse
Myittha
Sale
Salin
Sidoktaya
Natmauk
Sagu
Minbu
Magwe
Myothit
Taungdwingyi
Pinlaung
Sakoe
Kamaik
Lotpat
Mawlaik
Paungbyin
Pinlebu
Ye-u
Shwebo
Monywa
Ayadaw
Chindwin
Mu
Kaladan
Ramree
Daletme
Paletwa
Maungdaw
Buthidaung
Donbaik
Akyab
Myebon
Kyaukpyu
Thandwe
Ann
Taungup
Sandoway
Thayetmyo
Prome
Henzada
Myaungmya
Bassein
Pyapon
Rangoon
Moulmein
Thaton
Tavoy
Mergui
Victoria
Mt.
Kyaukpyu
Ann
Taungup
Sandoway
Thayetmyo
Prome
Henzada
Myaungmya
Bassein
Pyapon
Rangoon
Moulmein
Thaton
Tavoy
Mergui


TENASSERIM
PENINSULA
ANDAMAN
ISLANDS
RANGOON
MARTABAN
SALWEEN
CHINDWIN
Kaladan
CHIN HILLS
COMBERMERE BAY
FOREST STRAIT
93°
94°
95°
96°
97°
98°
99°
15°
16°
17°
18°
19°
20°
21°
22°
23°
24°
25°

LEGEND
PROPOSED FOR CONSTRUCTION
IMMEDIATE INVESTIGATION
LONG RANGE PROJECTS
PROPOSED FOR PUMPED IRRIGATION
BURMA
PROPOSED & FUTURE RESERVOIRS
IRRIGATION OR MULTI-PURPOSE PROJECTS
92°
93°
94°
95°
96°
97°
98°
99°
100°
101°
28°
27°
26°
25°
24°
23°
22°
21°
20°
Kumjawng Pass
Putao (Fort Hertz)
Chau Kan R.
Tarl Wang
Kading
Mogalle
Rang Seng
Hukawng Valley
Triangle
Tsumaw
Shingoot
UPPER IRRAWADDY RIVER
Myitkyina
Sadon
Singkaling Hkamti
Kamaing
Mogaung
Tamanthi
Indawgyi Lake
Sima
Homalin
Banmauk
Mawlu
Indaw
Shwegu
Bhamo
Katha
Paungbyin
Pinlebu
Sittaung
Mawlaik
MYITTHA RIVER
Tiddim
Pt. White
Kalemyo
Falam
MU RIVER
Pyingaing
Masein
Kanbalu
Thabeikkyin
Mogok
Tagaung
Tigyaing
SHWELI RIVER
Shweli
Namhkan
SALWEEN
Hyu-hkok
Kunlong
Esenwi
Monglum
Namtu
Namhsan
Mong Mio
Lashio
WA STATES
Mong Hsaw
Hsipaw
Gokteik
Mongyai
Tahut
Mengma
Shwebo
Singu
Madaya
Sheinmaga
Kani
Bugalin
Monywa
Gangaw
Kabaw Valley
Maymyo
MANDALAY
Mongtung
Kengtung
Monaksu
Kehsi Mansam
MYITNGE RIVER
AKOKKWA
PUMPED IRRIGATION
Myingyan
Kyaukse
Meng Hung
Meng Nawng
Meng Song
Meng Mao
Meng Lwe
Keng Tung
Meng Yawng
Lawksawk
Loilem
Takaw
Pyawbwe
Meiktila
Thazi
Taunggyi
Yaksawk
Kalaw
Mong Nai
Mong Hsat
Mong Pan
Yamethin
SINTHE CHAUNG
Pinlaung
Loilut
Mawkmai
Samka
Namtok
Sakoe
Mong Kyawt
CHIN HILLS
Paletwa
Kaladan R.
Mt. Victoria
Saw
Pagan
Chauk
Sale
Salin
Yenangyaung
Watmauk
YIN RIVER
Myothit
Taungdwingyi
Minbu
Sagu
Magwe
MON RIVER
Akyab
Donbaik
Myebon
Minbya
Myohaung
Ramree
Thandwe
Kyaukpyu
Maungdaw
Buthidaung
Myauktaw
Naaf R.
Yaw
Minhla
Kyaukpadaung
Mahlaing
Taungtha
Paukkaung
Yesagyo
Myaing
Tilin
Paleik
Gangaw
Pauk
Kyaukse
Kyaukpadaung
Thayetmyo
Prome
Henzada
Bassein
Myaungmya
Pyapon
Rangoon
Moulmein
Martaban
Tavoy
Mergui
Victoria Point
Kawkareik
Myawaddy
Kyondo
Thaton
Papun
Pegu
Toungoo
Shwegyin
Kyaikto
Sittang R.
Salween R.
Gulf of Martaban
Andaman Sea
Bay of Bengal
Miles
0
20
40
60
80
100 Miles

MULTI-PURPOSE PROJECTS

BURMA

PRESENT INSTALLATIONS (1939) AND FUTURE EL

(REPORT COMPILED BY U MAUNG AYE, HYDRO-ELECTR

Serial No.	District or States	Area in Square Miles	POPULATION (1941)				NORMAL RAINFALL In inches Per Annum	Existing Public E. Supply Installed Plant K. W.	EXISTING ELECTR
			Urban (Thousands)	Rural (Thousands)	Total (Thousands)	Density Per Sq. Miles			K. W.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	ARAKAN DIVISION								
1	Akyab	5,176	40.3	720.4	760.7	147.0	203.37	189	...
2	Kyaukpyu	4,767	4.2	248.1	252.3	52.9	187.79	...	...
3	Sandoway	4,157	4.1	135.6	139.7	33.6	211.28	...	...
	PEGU DIVISION								
4	Pegu	4,124	40.7	542.3	583.0	141.3	127.37	356	...
5	Hanthawaddy	1,931	25.6	433.9	459.5	238.0	112.61	*213	9,532
6	Insein	1,914	51.9	335.4	387.3	202.3	90.25	24,121	403
7	Rangoon	24.8	500.8	...	500.8	20,193.5	99.03		4,294
	(Water Area)	52.3							
8	Tharrawaddy	2,815	51.3	542.6	593.9	210.9	87.84	539	...
9	Prome	2,936	50.2	386.7	436.9	148.7	46.89	487	...
10	Toungoo	6,456	36.9	438.0	474.9	73.5	82.96	640	62
	IRRAWADDY DIVISION								
11	Bassein	4,145	56.9	607.8	664.7	160.3	109.13	465	...
12	Henzada	2,762	44.4	648.9	693.3	249.2	83.73	428	...
13	Myaungmya	2,815	24.9	463.1	488.0	173.3	103.78	418	...
14	Maubin	1,642	25.2	402.9	428.1	260.7	96.17	296	...
15	Pyapôn	2,076	37.8	347.2	385.0	185.4	96.05	434	...
	TENASSERIM DIVISION								
16	Amherst	7,410	72.1	521.4	593.5	80.0	189.62	553	...
17	Thatôn	4,870	23.5	569.1	592.6	121.0	216.23	272	52
18	Tavoy	5,390	29.0	182.7	211.7	39.2	214.74	154	4,464
19	Mergui	10,906	20.4	160.4	180.8	16.5	161.24	137	...
	MAGWE DIVISION								
20	Magwe	3,724	40.5	519.4	559.9	150.3	31.42	84	20,000
21	Minbu	3,594	21.2	281.2	302.4	81.4	35.38	51	...
22	Thayetmyo	4,642	21.8	275.6	297.4	64.0	45.15	77	1,800
23	Pakôkku	5,356	23.1	536.6	559.7	104.5	23.91	180	1,200
	MANDALAY DIVISION								
24	Mandalay	2,115	183.2	225.7	408.9	193.3	33.16	1,970	1,204
25	Kyauksè	1,245	7.4	145.1	152.5	122.4	29.84	39	...
26	Meiktila	2,238	9.2	334.8	344.0	153.7	33.43	40	...
27	Yamèthin	4,196	33.1	430.1	463.2	110.3	38.02	325	...
28	Myingyan	2,710	33.6	505.5	539.1	199.0	26.45	197	...
	SAGAING DIVISION								
29	Sagaing	1,878	19.2	368.1	387.3	206.3	30.96	56	...
30	Shwebo	5,749	15.0	481.2	296.2	86.3	33.80	75	...
31	Mytikyina	12,172	7.3	291.0	298.3	34.5	78.99	95	...
32	Bhamo	4,146	7.8	121.5	129.3	31.1	72.01	61	...
33	Upper Chindwin	14,867	2.3	207.3	209.6	14.1	66.85	...	...
34	Lower Chindwin	3,681	10.8	416.5	427.3	116.1	31.05	92	...
35	Katha	7,593	15.2	275.8	291.0	38.3	58.37	467	...
	NORTHERN SHAN STATES								
36	Northern Shan States ...	21,400	22.3	667.6	689.9	32.2	...	232	14,80
	SOUTHERN SHAN STATES								
37	Southern Shan States ...	36,416	22.5	904.6	927.1	25.4	...	65	...
	KARENNI STATE								
38	Karenni	4,519	...	70.5	70.5	15.6	...	...	98
	Total ...	2,18,610.1	1,635.7	14,744.6	16,380.3	75.0 (Mean)	...	33,808	58,97

(* See Explanatory Note)

PRESENT INSTALLATIONS (1939) AND FUTURE ELECTRIC POWER NEEDS

(REPORT COMPILED BY U MAUNG AYE, HYDRO-ELECTRIC SURVEY ENGINEER)

Area in Square Miles	POPULATION (1941)				NORMAL RAINFALL In inches Per Annum	Existing Public E. Supply Installed Plant K. W.	EXISTING INDUSTRIAL ELECTRICAL PLANT		Existing Industrial Steam Installations in Equivalent K. W. (Max: Demand)	Assumed Industrial Max: Demand (10a) + (11) K. W.	ASSUMED MAX: DEMAND FOR DOMESTIC AND MINOR INDUSTRIES			Total Maximum Demand (12) + (15) K. W.
	Urban (Thousands)	Rural (Thousands)	Total (Thousands)	Density Per Sq. Miles			K. W.	Maximum Demand			Urban at 30 Units/ Head K. W.	Rural at 5 Units/ Head K. W.	Total (13) + (14) K. W.	
(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(10a)	(11)	(12)	(13)	(14)	(15)	(16)
5,176	40.3	720.4	760.7	147.0	203.37	189	...	...	2,328	2,328	863	2,570	3,433	5,761
4,767	4.2	248.1	252.3	52.9	187.79	...	...	...	60	60	90	885	975	1,035
4,157	4.1	135.6	139.7	33.6	211.28	...	...	...	90	90	88	484	572	662
4,124	40.7	542.3	583.0	141.3	127.37	356	...	...	4,060	4,060	874	1,935	2,806	6,866
1,931	25.6	433.9	459.5	238.0	112.61	*213	9,532	5,719	5,104	10,823	548	1,548	2,096	12,919
1,914	51.9	335.4	387.3	202.3	90.25	24,121	403	240	3,612	3,852	1,111	1,197	2,308	6,160
24.8	500.8	...	500.8	20,193.5	99.03		4,294	2,577	9,880	12,457	10,719	...	10,719	23,176
52.3														
2,815	51.3	542.6	593.9	210.9	87.84	539	...	...	3,284	3,284	1,098	1,936	3,034	6,318
2,936	50.2	386.7	436.9	148.7	46.89	487	...	...	2,627	2,627	1,074	1,379	2,453	5,080
6,456	36.9	438.0	474.9	73.5	82.96	640	62	37	2,149	2,186	790	1,562	2,352	4,538
4,145	56.9	607.8	664.7	160.3	109.13	465	...	...	3,403	3,403	1,218	2,168	3,386	6,789
2,762	44.4	648.9	693.3	249.2	83.73	428	...	...	3,433	3,433	950	2,315	3,265	6,698
2,815	24.9	463.1	488.0	173.3	103.78	418	...	...	3,224	3,224	533	1,652	2,185	5,409
1,642	25.2	402.9	428.1	260.7	96.17	296	...	...	1,522	1,522	539	1,437	1,976	3,498
2,076	37.8	347.2	385.0	185.4	96.05	434	...	...	2,060	2,060	809	1,238	2,047	4,107
7,410	72.1	521.4	593.5	80.0	189.62	553	...	...	4,597	4,597	1,543	1,860	3,403	8,000
4,870	23.5	569.1	592.6	121.0	216.23	272	52	30	2,657	2,687	503	2,030	2,533	5,220
5,390	29.0	182.7	211.7	39.2	214.74	154	4,464	2,678	895	3,573	621	652	1,273	4,846
10,906	20.4	160.4	180.8	16.5	161.24	137	...	...	478	478	437	572	1,009	1,487
3,724	40.5	519.4	559.9	150.3	31.42	84	20,000	12,000	8,716	20,716	867	1,853	2,720	23,436
3,594	21.2	281.2	302.4	81.4	35.38	51	...	...	2,119	2,119	454	1,003	1,457	3,576
4,642	21.8	275.6	297.4	64.0	45.15	77	1,800	1,080	1,910	2,990	467	983	1,450	4,440
5,356	23.1	536.6	559.7	104.5	23.91	180	1,200	720	2,478	3,198	495	1,914	2,409	5,607
2,115	183.2	225.7	408.9	193.3	33.16	1,970	1,204	720	3,075	3,795	3,921	805	4,726	8,521
1,245	7.4	145.1	152.5	122.4	29.84	39	...	...	716	716	158	518	676	1,392
2,238	9.2	334.8	344.0	153.7	33.43	40	...	...	418	418	197	1,194	1,391	1,809
4,196	33.1	430.1	463.2	110.3	38.02	325	...	...	1,821	1,821	708	1,534	2,242	4,063
2,710	33.6	505.5	539.1	199.0	26.45	197	...	...	985	985	719	1,803	2,522	3,507
1,878	19.2	368.1	387.3	206.3	30.96	56	...	...	418	418	411	1,313	1,724	2,142
5,749	15.0	481.2	296.2	86.3	33.80	75	...	...	2,119	2,119	321	1,717	2,038	4,157
12,172	7.3	291.0	298.3	34.5	78.99	95	...	...	1,015	1,015	156	1,038	1,194	2,209
4,146	7.8	121.5	129.3	31.1	72.01	61	...	...	239	239	167	433	600	839
14,867	2.3	207.3	209.6	14.1	66.85	...	...	...	1,075	1,075	49	740	789	1,864
3,681	10.8	416.5	427.3	116.1	31.05	92	...	...	806	806	231	1,486	1,717	2,523
7,593	15.2	275.8	291.0	38.3	58.37	467	...	...	657	657	325	984	1,309	1,966
21,400	22.3	667.6	689.9	32.2	...	232	14,800	8,880	1,015	9,895	477	2,389	2,866	12,761
36,416	22.5	904.6	927.1	25.4	...	65	...	...	358	358	482	3,227	3,709	4,067
4,519	...	70.5	70.5	15.6	...	...	980	588	...	588	...	251	251	839
2,18,610.1	1,635.7	14,744.6	16,380.3	75.0 (Mean)	...	33,808	58,971	35,269	85,403	1,20,672	35,010	52,605	87,615	2,08,287

(* See Explanatory Note)

APPENDIX C

WATER POWER SITES INVESTIGATED

SITE No.	NAME	HEAD IN FEET	CUSECS (D.W.F.)	K.W.	DISTANCE TO NEAREST TOWN
1	Bilin Chaung	Figures not available	...	...	Pegu 55 miles
2	Shwegyin Chaung (Yunzalin) ...	Figures not available	...	...	Pyu 40 miles
3	Yunzalin River (tributary of the Salween)	...	...	110,000	Rangoon 125 miles
4	The Thank-Ye-Gat (tributary of the Sittang)	150	550	5,156	Toungoo 15 miles
5	Sittang River (see Paunglaung which are the headwaters of river)	...	...	...	No figures available
6	Nam Kwe Lake (near Yamèthin)	1,100	50	3,437	Yamethin 10 miles
7	Heho Falls (S.S.S.) ...	770	57	2,743	Heho 5 miles
8 9 10	The Panlaung (tributary of the Myitgne)	800	3	150	Thazi 30 miles
11	Nam Tong (tributary of the Salween)	345	1,000	21,562	Loilem 50 miles
12 13 14	Nam Pang (tributary of the Salween) (three possible sites)	180	2,000	22,500	Kengkham 8 miles
15 16	Makchinu Chaung (2 sites) ...	250	16	250	Loilem 50 miles Heho 50 miles
17 18	Zawgyi River (tributary of Myitgne) (Ming Hing Falls, 2 sites)	400	200	5,000	Kyauksè 35 miles
19	Pyaungshoo Rapids on Nam Tu River	95	1,500	8,906	Maymyo 25 miles
20	Nam Hsaung Hka (tributary of Nam Tu)	...	...	...	do
21	Kin Chaung (tributary of Nammeik Chaung)	58	20	725	Shwebo 55 miles
22	Shweli River	1,000	3,000	187,500	Lashio 50 miles
23	Nam Mangkaba Chaung ...	1,300	8	650	Bhamo 50 miles
24	Nam Lam (tributary of Shweli) ...	800	10	500	Namtu 25 miles
25	Nam Hpaung (do do)	750	15	703	do
26	Nam Chit (do do)	700	10	437	do
27	Nam Pam (do do)	100	50	312	do
28	Nampak Hka (do Taping)	880	200	11,000	Bhamo 50 miles
29	Umungya Hka (do do)	2,300	100	14,375	Bhamo 15 miles
30	Taping River (Near Bhamo)	35	200	437	Bhamo 10 miles
30 (a)	do Scheme 2 ...	57	2,000	7,125	do
30 (b)	do Scheme 3 ...	100	2,000	12,500	do
31	Nam Tabet (Upper Tabak Hka) ...	Figures not available			Myitkyina 30 miles
32	Saingdaing Falls (near Akyab) ...	135	200	1,687	Akyab 45 miles
33	Kyaukpyu Chaung (near Tavoy) ...	1,220	3	229	Tavoy 30 miles
34	Hpaungdaw Chaung (do) ...	900	4	225	Tavoy 15 miles
		Total ...	418,109 say 400,000 K.W.		

BURMA

HYDRO POWER PROJECTS

FIRST PRIORITY PROJECTS

NAME	INITIAL POWER	ULTIMATE POWER
PEGU	20,000 K.W.	30,000 K.W.
SAINGDIN	30,000 K.W.	60,000 K.W.
MON	50,000 K.W.	75,000 K.W.

FIRST PRIORITY — Dam — Transmission Line

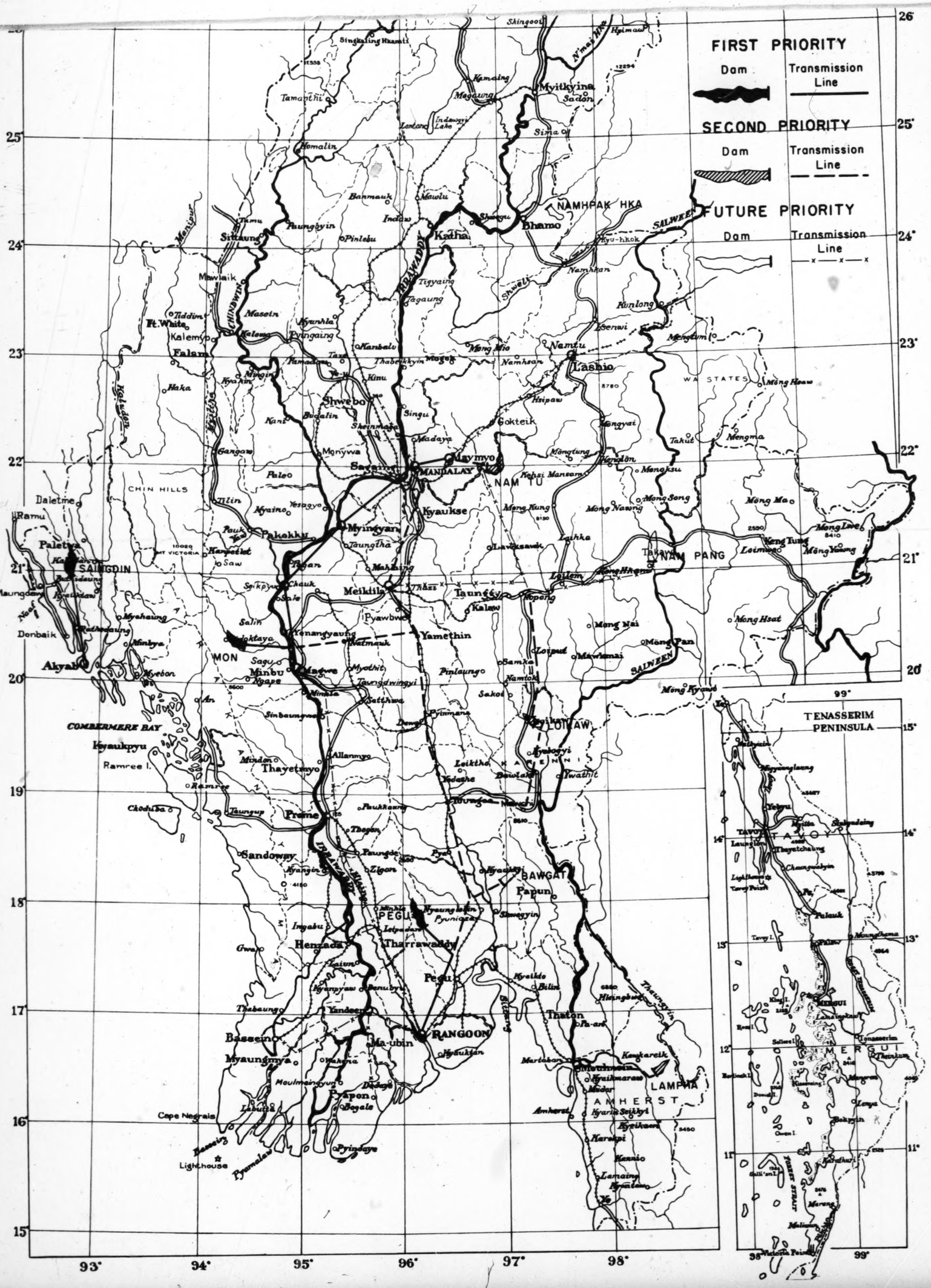
SECOND PRIORITY — Dam — Transmission Line

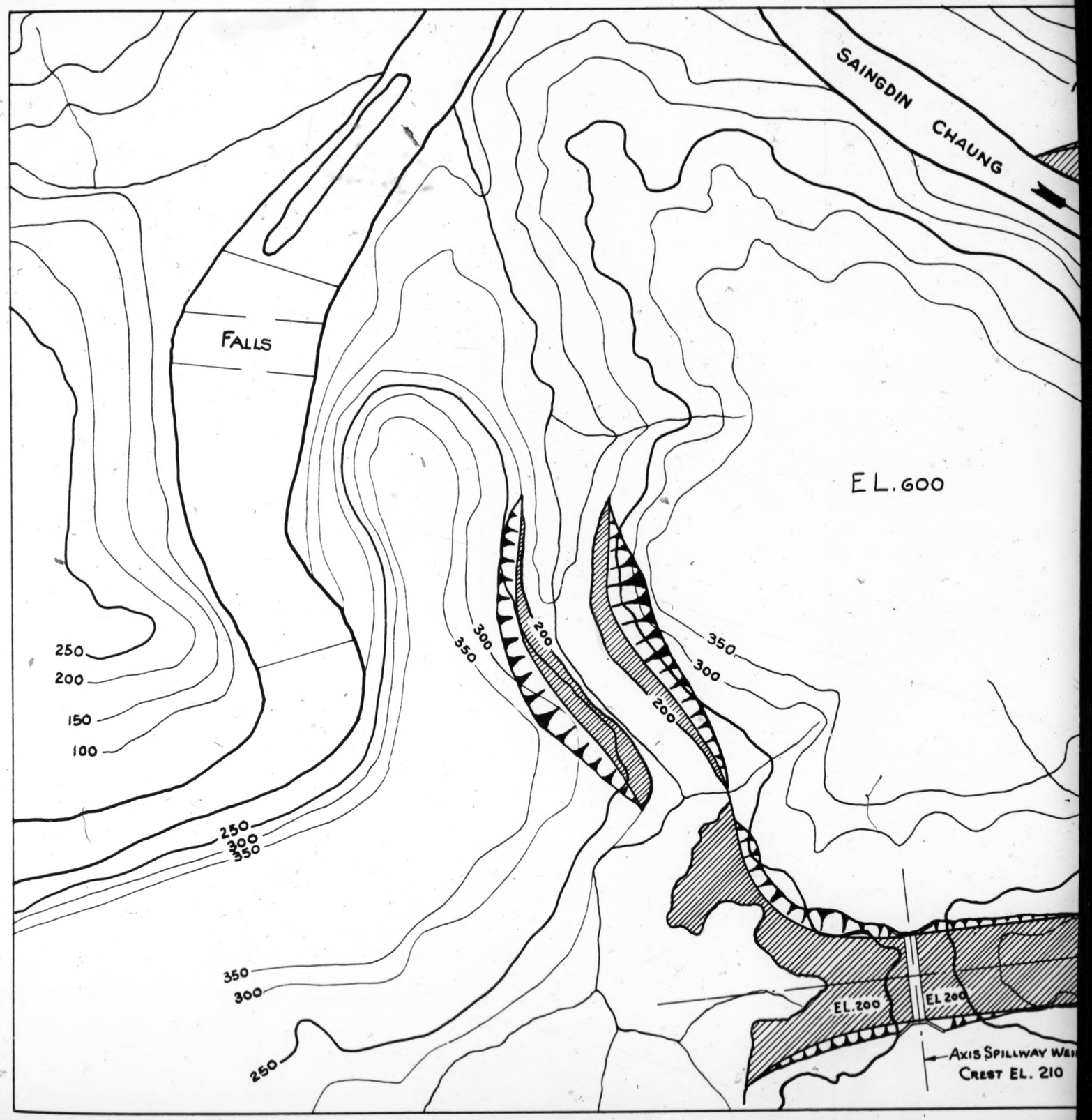
FUTURE PRIORITY — Dam — Transmission Line

92° 93° 94° 95° 96° 97° 99° 100° 101°

28° 27° 26° 25° 24° 23° 22° 21° 20° 15°

Kumjawng Pass · Jari Wang · Putao (Fort Hertz) · Chau Kan R. · Tawang · Magaiba · Kleding · Rang Seng · Triangle · Hukawng Valley · Chanyag · Maliangkan · Sumprabum · Nmai Hka · Tsumvaw · Hpimaw · Shingoot · Singkaling Hkamti · Tamanthi · Kamaing · Myitkyina · Sadon · Indawgyi Lake · Lontaing · Sima · Homalin · Banmauk · Mawlu · Indaw · Shwegu · Katha · Bhamo · NAMHPAK HKA · SALWEEN · Hpu-hkok · Sittaung · Paungbyin · Pinlebu · Mawlaik · Tigyaing · Tagaung · Shweli · Namkhan · Hunlong · Ft. White · Tiddim · Kalemyo · Falam · Pingaing · Kyanhla · Kanbalu · Mong Mio · Namtu · Lashio · Hsipaw · Mong Hsaw · WA STATES · Shwebo · Singu · Kant · Bugalin · Kinu · Haka · Gokteik · Mongyai · Takut · Mengma · Gangaw · Monywa · Sayemyo · MANDALAY · Madaya · Mongtung · Hsenlon · Mengksu · Kohsi Mansam · NAM TU · CHIN HILLS · Paleo · Tilin · Kyaino · Yesagyo · Daletme · Ramu · Kyaukse · Mong Kung · Mong Nawng · Mong Song · Mong Ma · Mong Lwe · Myingyan · Pakokku · Taungtha · Lawksawk · Laihka · Keng Tung · Mong Kaing · Paletwa · SAINGDIN · Saw · Mahaing · Meiktila · Thazi · Taunggyi · Loilem · NAM PANG · Leimon · Nong Hsat · Maungdaw · Salin · Pyawbwe · Yamethin · Donbaik · Akyab · MON · Sagu · Minbu · Myothit · Pinlaungo · Samka · Loisad · Mawkmai · Mong Nai · Mong Pan · SALWEEN · Mong Kyawd · TENASSERIM PENINSULA · COMBERMERE BAY · Kyaukpyu · Allanmyo · Kyaikpyi · MYAWADDY · CHINDWIN · Mengwi · Kaladan · Mayu R.


FIRST PRIORITY
Dam
Transmission Line
SECOND PRIORITY
Dam
Transmission Line
FUTURE PRIORITY
Dam
Transmission Line
Shingoot
Singkaling Hkamti
Hpimaw
Myitkyina
Sadon
Kamaing
Tamanthi
Indawgyi Lake
Sima
Homalin
Banmauk
Mawlu
NAMHPAK HKA
Shwegu
Bhamo
SALWEEN
Sittaung
Paungbyin
Pinlebu
Katha
Mawlaik
Tigyaing
Tagaung
Shwebo
Monywa
Sagaing
MANDALAY
Maymyo
Kyaukse
NAM TU
Lashio
Namtu
Hsipaw
Mong Hsaw
WA STATES
Takut
Mengma
Mong Ma
Mong Lwe
Mong Yang
TAWNG PANG
Mong Hsat
Mong Pan
Mong Nai
Loilem
Taunggyi
Meiktila
Yamethin
Pyawbwe
Pakokku
Myingyan
Kyaukse
Lawksawk
Laihka
Mong Nawng
Mong Kung
Mong Song
Mong Kyawt
Mawlamyaing
Moulmein
Thaton
Martaban
Amherst
Kyaikto
Sittang
Bilin
Pegu
Tharrawaddy
Henzada
Prome
Thayetmyo
Minbu
Magwe
Myothit
Salin
Pakokku
Pagan
Chauk
Yenangyaung
Akyab
Donbaik
Maungdaw
Paletwa
Daletme
Ramu
Kalemyo
Falam
Tiddim
Ft. White
Haka
Gangaw
Pauk
Kanbalu
Singu
Madaya
Shwebo
Monywa
Sagaing
Ava
Amarapura
Kyaukse
Myingyan
Meiktila
Yamethin
Pyawbwe
Thazi
Kyaukpadaung
Salin
Chauk
Yenangyaung
Minbu
Magwe
Myothit
Taungdwingyi
Pakokku
Pagan
Nyaungu
Bagan
Sinbaungwe
Gwa
Ramree
Ramree I.
Cheduba
Taungup
Sandoway
Kyaukpyu
Thayetmyo
Prome
Henzada
Bassein
Myaungmya
Cape Negrais
Lighthouse
Pyindaye
Pyapon
Bogale
Dedaye
Moulmeingyun
Thabaung
Yandoon
Kyangin
Ingabu
Letpadan
Pyuntaza
Pegu
Tharrawaddy
RANGOON
Hlaingbwe
Thaton
Martaban
Amherst
Kyaikto
Sittang
Bilin
Kyaikkami
Ye
Tavoy
Mergui
Victoria
Tenasserim
Kawkareik
Myawaing
Myeik
Lenya
Bokpyin
Kadan I.
Forest Strait
Merang
Malacca Point
Gulf of Martaban
Moulmein
Amherst
Lampha
Ataran
Salween
Sittang
Irrawaddy
Chindwin
Mu
Kaladan
Manipur
Kyaukpyu
Ramree I.
Cheduba
Sandoway


SAINGDIN CHAUNG
FALLS
EL. 600
250
200
150
100
250
300
350
300
350
200
350
300
200
350
300
250
EL. 200
EL 200
AXIS SPILLWAY WEI
CREST EL. 210

INTAKE PORTAL - GATE TOWER
CONCRETE PLUG

SAINGDIN CHAUNG

OUTLET PORTAL
INV: EL. 58.0

1 ON 3
DOWN

1 ON 3
DOWN

℄ UNIT 1
℄ UNIT 2
℄ UNIT 3 (FUTURE)

50 FT. FALL

℄ DIVERSION & POWER TUNNEL

SAINGDIN CHAUNG

EL. 600

℄ AXIS EARTH DAM

EL. 200

EL 200

AXIS SPILLWAY WEIR
CREST EL. 210

EL 190

OWER

UTLET PORTAL
NV: EL. 58.0

℄ UNIT 1
℄ UNIT 2
℄ UNIT 3 (FUTURE)

50 FT. FALL

℄ DIVERSION & POWER TUNNEL

SAINGDIN CHAUNG

EL. 650

250
200
150
100
50

250
200
150
100

100
150
200
250

350
300
250
200
150
100
50

G D I N C H A U N G

S A I N G

℄ SPILLWAY

PROPOSED HYDRO-ELECTRIC DEVELOPMENT

SAINGDIN RIVER AT TANDIN FALLS

GENERAL LAYOUT, DAM & POWER HOUSE

SCALE IN FEET

400 0 400 800 1200

Section X

WATER RESOURCES

A. GENERAL.

"It is now generally accepted throughout the world that it is in the best interests of every country to see that its water problems are dealt with on a national or collective basis. Their competent solution has certainly enhanced the economic position of the countries where this has been achieved. Burma, which is blessed with such adequate water resources, must set these achievements as her ultimate goal."

The above paragraph is quoted from a paper by I. Walker, Member, The Association of Engineers, Burma, dated 1947, entitled "Water Resources of Burma with Special Reference to Long-Term Development". The statement points up the necessity of sound planning for what is one of Burma's greatest natural resources. A brief description of this resource follows, starting with the fabulous Irrawaddy River.

B. IRRAWADDY RIVER.

1. GENERAL DESCIPTION OF RIVER SYSTEM. The Irrawaddy originates at about 28° North Latitude in a major extension of the Himalaya Mountains, having permanent snow fields and peaks over 19,000 feet above sea level. The river flows generally southward 1300 miles to its mouth on the Bay of Bengal, 16° North Latitude. The total drainage area is 155,000 square miles including 15,000 square miles of delta area. Other physical data are given in the following tabulation.

THE IRRAWADDY RIVER

Locality	*Mile*	*Flood Flow (Thous. C.F.S.)*	*Drainage Area (Square Miles)*	*Annual Output (Thous. Ac. Ft.)*
Mouth of China Bakir River..	0		155,000	310,000
Myanaung	218	2,000	140,000	280,000
Confluence Chindwin and Irrawaddy	559		117,870	260,000
Mandalay	670		48,160	140,000
Katha	890		32,400	119,000
Irrawaddy Confluence	1160		17,900	90,000
Source	1290			

2. THE DELTA. South of Henzada the Irrawaddy Delta has several outlets to the sea through meandering channels. It is flat, poorly drained with intense rainfall during the monsoon season. Many areas are liable to inundation, although there are numerous protective levees which are effective normally. Raising and/or extension of these levees as well as provision of drainage and pumping facilities will be given detailed study in a later Report.

The Delta has a maximum width (east-west) of 200 miles, and maximum length of 150 miles. The principal water use is for agriculture and navigation. Almost unlimited supplies of ground water are available for industrial and domestic use with moderate pump lift. At Rangoon clear potable water originates in sand beds 280 feet below ground level and rises to 30 feet below. An artesian condition exists north of Rangoon at the Government Spinning Mill and probably numerous other points.

3. THE CENTRAL VALLEY. North of Henzada the central valley extends 250 miles to Pakokku, varying in width from 60 miles near its south end to 160 miles at Pakokku. The rainfall varies from moderate heavy (90 inches per year) near the south end to about 30 inches at Myingyan. Irrigation is required as far south as Thayetmyo, water being obtained from numerous perennial flowing tributaries entering from the Arakan Yomas and Pegu Yomas. The principal streams in this group proceeding from the southern limit of the Central Valley are here listed:

CENTRAL IRRAWADDY TRIBUTARIES

River	*Length in Miles*	*Elev. at Source*	*Drainage Area (Sq. Mi.)*	*Low Flow (C.F.S.)*	*Annual Output (Thous. A.F.)*
Matun	116	3,750	1,670		1,690
Man	78	4,250	717	20	725
Mon	196	10,000	2,314	200	2,340
Salin	94	8,500	1,350	20	
Yin		2,000	2,410		1,540
Pin		5,000	1,014		
Yaw	148	8,750	2,575		1,900

4. THE NORTHERN BASIN. The northern Irrawaddy basin including the Chindwin, Shweli and Myitnge Rivers contains vast power and irrigation resources. The annual rainfall varies from 30 inches to 160 or more depending on the altitude. Navigation exists on the main river to Myitkyina (Mile 1,130) and to Homalin (Mile 397) on the Chindwin. Irrigation is desirable over much of the northern basin and minor projects have been developed in the Mandalay and Sagaing Divisions.

Major tributaries apparently suitable for power and irrigation are as follows:

MAJOR TRIBUTARIES
CHINDWIN & UPPER IRRAWADDY

River	*Length in Miles*	*Elev. at Source*	*Drainage Area (Sq. Mi.)*	*Annual Output (Thous. Ac. Ft.)*
Chindwin River Basin				
Myittha	218	8,000	9,277	15,000
Khampat Yu	132	6,750	2,396	4,800
Uru			4,792	9,700
Nam Lalei	132	6,000	4,955	10,000
Upper Irrawaddy Basin				
Samon			3,360	1,500
Panlaung			1,372	1,200
Zawgyi	152	4,750	1,960	2,300
Myitnge (Nam Tu)	328	4,500	11,440	20,000
Chaungmagyi	62	5,500	2,210	2,200
Shweli	380	11,000	8,805	17,300
Taping	140	11,250	2,785	7,600
Mu	270	1,750	7,275	5,800
Mogaung	164	2,750	3,256	7,700
Mali Kha	228	16,000	9,093	46,500

C. ARAKAN RIVERS.

West of the Irrawaddy Valley lie the coastal mountains extending from low foot hills near Bassein (Lat. 16°) to the Indian Border (Lat. 24°). The foot hills, termed the Arakan Yomas, increase steadily toward the north culminating in 10,000-foot Mount Victoria (Lat. 21°). North of this peak there is a continuous range of mountains, 8,000 to 9,000 feet in height, terminating in the rugged Chin Hills. The coastal mountains are heavily watered. Proceeding from the southern extremity the principal rivers on the west slope discharging directly into the Bay of Bengal are as follows:

ARAKAN RIVERS

River	*Length in Miles*	*Elev. at Source*	*Drainage Area (Sq. Mi.)*	*Annual Output (Thous. Ac. Ft.)*
Lemro	168	5,500	3,910	20,300
Kaladan	404	8,000	8,730	43,600
Mayu	96	2,000	1,975	9,200

D. PEGU RIVER.

East of the Irrawaddy Central Valley separating it from the Sittang River, lie the Pegu Yomas, a range of low mountains about 150 miles in length. Out of the southern portion and discharging into the Rangoon River, flows the Pegu River. The total length of the river is 166 miles and its elevation at the source is about 2,700 feet. The drainage area is 2,065 sq. mi. and average annual output 6,500,000 acre feet. In view of its proximity to the Rangoon market, high annual run-off and adequate storage possibilities, the Pegu has promise as a source of hydro-electric power which can be scheduled for early development.

E. SITTANG RIVER.

The Sittang River originates near Yamethin (Lat. 20° 15′) and discharges into the Gulf of Martaban (Lat. 17°15′) about 60 miles east of Rangoon. The river parallels the Irrawaddy in its southward flow. It has a valley length of about 200 miles and width of 40 to 50 miles. The drainage area is 13,280 sq. mi. and annual output 34,000,000 acre feet. Its source is at Elev. 1,500 feet. Numerous large tributaries having good sustained flow enter the river from both east and west sides. Several of these have sufficient output and head to be considered for irrigation and power. Among these are the Shwegyin and Kyaukkyi, discussed in existing reports as potential power streams in conjunction with diversion of water from the Yunzalin drainage. Installations up to 150,000 horsepower have been contemplated, to supply power to Rangoon and other "central valley" towns.

F. BILIN RIVER.

East of the Sittang and flowing parallel there to is the Bilin River, 935 sq. mi. drainage area and 5,000,000 acre feet annual run-off. Its source is at El. 4,500 and outlet the Gulf of Martaban. The valley length is about 100 miles and maximum width 20 miles. Flow is well sustained in the rainy season with over 150 inches annual rainfall. The river is a possible source of power although somewhat remote from load centers.

G. SALWEEN RIVER.

Farther east is the Salween River, which crosses the China-Burma boundary at River Mile 760 and stream bed Elev. 2,000+. Thence it flows in a southerly direction discharging into the Gulf of Martaban at Moulmein. The river has an average gradient of 2.6 feet per mile without notable concentrated falls. Throughout most of its length in Burma the river flows in a major canyon and numerous large tributaries enter by steep channels or sizeable cascades. Consequently, the power potentialities on the tributaries are very large, but located far from existing markets. The downstream 70 miles of the Salween is located in an alluvial plain where meanderings and alternate channels exist. The river is navigable in this lower reach, and is said to be passable part of the year for small boats proceeding downstream from the China border to the sea.

MAJOR TRIBUTARIES OF SALWEEN RIVER

River	Drainage Area (Sq. Mi.)	Annual Output (Thous. Ac. Ft.)
Western Tributaries		
Donthami	1090	5,200
Yunzalin	1130	6,000
Nam Pawn	7290	16,300
Nam Teng	5880	14,100
Nam Pang	4890	12,500
Eastern Tributaries		
Ataran	2200	11,700
Gyaing	3680	19,400
Nam Hsim	1980	4,400
Nam Hka	3980	8,900
Nam Ting	3460	8,900

H. TENASSERIM RIVERS.

In the panhandle south of Moulmein are the Great Tenasserim and a number of smaller rivers where navigation will be the principal use. However, there are power sites suitable for local supply, where 200 to 250-inch rainfall occurs annually.

TENASSERIM RIVERS

River	Drainage Area (Sq. Mi.)	Annual Output (Thous. Ac. Ft.)
Lenya	1230	6,900
Great Tenasserim	6840	41,600
Tavoy	1110	6,900

I. PRECIPITATION.

The precipitation for all parts of Burma obtained from long term records, Ministry of Agriculture and Forests, is shown on map entitled: "Average Annual Precipitation in Inches" which is attached at the end of this section. The rainfall varies from 200 inches or more on the Arakan and Tenasserim Coasts to a low area of 30 inches near Chauk and Myingyan. At the sources of the Yunzalin River (El. 8500) the average rainfall is 224 inches, and in North Burma it averages 160 inches near the Irrawaddy and Chindwin sources.

The distribution of rainfall throughout the average year is indicated for selected stations in the table shown below.

J. RUN-OFF.

Estimated run-off factors vary from less than 30% in the dry belt to 75% in the precipitous torrents of the Kachin States. The estimated factors are based on recorded discharge and rainfall for the Rangoon Water Supply Reservoir at Gyobbyu and for the Bawgata hydro-electric project, where stream flow measurements were made in 1947-48.

K. FLOOD CONTROL.

Flood problems exist at many river communities on the Irrawaddy River. Shipping is damaged by sudden rises along the upper river. Irrigated land, headworks and canal systems are buried with gravel at frequent intervals, and abandonment of irrigated land has occurred because of such floods.

On the lower Irrawaddy a system of levees was constructed in the 19th century and has successfully withstood the annual floods, approaching 2,000,000 cusecs. However, the undercutting of levees and bank revetment is almost a continuous process. Set-back levees are constructed each year at points of attack, resulting in abandonment of land. This is reported to be less costly than constructing groins or revetment in most cases.

At times levee breaks have occurred resulting in a violent channel change and some erosion of the farm land. At Yandoon Island in the lower delta such a break occurred with consequent damage to land. The broken levee has been restored and the eroded area will be rebuilt by controlled flooding with silt laden water through a gate structure which is now under construction. The flooding process whether natural or artificial is a means of enriching the bottom lands for renewed agricultural production each year.

On the Pegu-Sittang canal, flood gates have deteriorated due to corrosion of the sheet metal incasing the wood construction. The design of new steel flood gates is in progress. All flood control work is under the direction of the Chief Engineer, Irrigation Department.

MONTHLY AND ANNUAL MEAN RAINFALL AT SELECTED STATIONS

District	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year
Rangoon	0.2	0.2	0.3	1.6	12.0	18.0	21.4	19.9	15.3	6.9	2.8	0.4	99.0
Mergui	0.9	2.0	3.1	5.3	16.9	29.4	31.6	29.2	26.4	12.1	3.7	0.7	161.3
Akyab	0.1	0.2	0.5	2.1	14.0	46.9	54.8	45.2	22.6	10.9	5.5	0.8	203.6
Myitkyina	0.4	0.9	0.9	2.0	6.0	15.1	19.2	15.5	9.7	6.8	1.2	0.4	78.1
Toungoo	0.1	0.3	0.2	1.9	7.7	14.1	17.6	19.1	12.1	7.4	1.8	0.5	82.9
Tharrawaddy	0.1	0.3	0.2	0.8	8.8	16.5	21.1	19.9	12.8	5.6	2.0	0.4	88.5
Prome	0.0	0.1	0.1	0.8	5.5	8.8	9.0	9.0	7.2	4.5	1.7	0.2	46.9
Meiktila	0.1	0.1	0.2	0.8	5.2	4.9	3.4	4.7	6.3	5.5	1.9	0.4	33.5
Maymyo	0.1	0.2	0.5	2.1	9.7	8.9	6.3	9.3	10.2	7.6	3.3	0.6	58.8
Lashio	0.3	0.3	0.6	2.2	6.9	9.8	12.0	12.7	7.8	5.7	2.8	0.9	62.0
Thayetmyo	0.0	0.0	0.1	0.7	5.3	7.9	8.0	8.5	7.8	4.9	2.3	0.0	45.5
Mandalay	0.1	0.1	0.2	1.1	5.9	5.5	3.3	4.6	5.7	4.7	1.6	0.4	33.2

L. IRRIGATION.

Irrigation projects have been developed in the Mandalay, Sagaing and Magwe Divisions. These consist of low head works and distribution canals. No important upstream storage is provided so that crop losses occur in dry years. Almost no crop diversification or dry weather irrigation is practiced. However, plans are actively under way for a large earth dam on the Sinthe Chaung, Yamethin District, to store 160,000 acre feet of water. This will irrigate 78,000 acres of land at any time of the year permitting a double crop in this area. Other proposed projects in the preliminary planning phase are shown in the following table:

PROPOSED IRRIGATION PROJECTS

	1	2	3	4	5
Project Name	*Tatkon*	*Myogaing*	*Natmauk*	*Pakokku*	*Lower Delta*
River	*Sinthe*	*Yan Be*	*Yin*	*Irrawaddy & Chindwin*	*Irrawaddy*
Reservoir Capacity (Ac. Ft.)	160,000	—	—	Pumping	Pumping
Lift in Feet	—	—	—	40′	10′
District	Yamethin	Magwe	Magwe	Pakokku	Divisions B & C
Land to be Irrigated (Acres)	78,000	30,000	30,000	500,000	4,000,000

The location of these proposed reservoirs is shown on map, entitled: "Irrigation and Multi-purpose Projects".

M. NAVIGATION.

Seasonal navigation is developed on the Irrawaddy as far north as Myitkyina and on the Chindwin to Homalin. Navigation extends 70 miles up the Salween. A complete system of channels connects all tidal rivers of the Irrawaddy Delta so that barge movement of rice to the deep water ports is customary. Numerous tidal estuaries and rivers on the Arakan and Tenasserim Coast are suitable for navigation. The Sittang River entrance is troublesome due to a bore; however, this area is bypassed by the Pegu-Sittang Canal bringing small boats from the Sittang into the Rangoon River.

N. PUBLIC WATER SUPPLY.

The following table summarizes available information on the prewar conditions relating to public water supply for 29 towns and communities:

TABULATION SHOWING TOWNS WITH A FULL OR PARTIAL PIPED WATER SUPPLY

Serial No	*Town*	*Source of Supply*	*Partial or Full*	*Remarks*
1	Rangoon	Reservoir	Full	
2	Akyab	Reservoir	Partial	
3	Bassein	Tube Wells	Partial	No distribution system
4	Maubin	Tube Wells	No information	
5	Yandoon	No information	No information	
6	Pegu	Reservoir	No information	
7	Insein	Tube Wells		No distribution system
8	Nyaunglebin	No information	No information	
9	Tharrawaddy	No information	No information	
10	Letpadan	No information	No information	
11	Minhla	No information	No information	
12	Prome	Irrawaddy River	No information	Partial distribution
13	Moulmein	Reservoir	No information	
14	Magwe	Tube Wells	No information	
15	Minbu	Infiltration Well	No information	
16	Thayetmyo	No information	No information	
17	Taungdwingyi	Tube Wells	No information	
18	Yenangyaung	River (Pinchaung)	No information	
19	Mandalay	Tube Wells	No information	Partial distribution
20	Myingyan	No information	No information	
21	Maymyo	Reservoir	No information	Separate supplies for Cantonment, Railways and town
22	Mogok	Reservoir	No information	
23	Monywa	Infiltration Gallery and wells	Partial	
24	Lashio	Reservoir	Partial	Partial distribution
25	Kalaw	Reservoir	Partial	
26	Taungyi	Reservoir	Partial	
	The following towns have partial private or military supply:			
1	Meiktila	Lake	Partial	Cantonment area only
2	Pyawbwe	Infiltration Gallery and wells	Partial	Cantonment area only
3	Syriam	Tube Wells	Partial	B.O.C. Supply

As can be seen the majority of existing water supplies are partial and of poor quality. Only 6% of the total population of Burma is served thereby. However, almost unlimited surface and ground water supplies of good quality for domestic and industrial use are available throughout the Irrawaddy valley and many other localities in Burma.

PROPOSED MULTIPLE PURPOSE RIVER PROJECTS

Project Name	*Mezali*	*Yeywa*	*Kalewa*	*Kyunhla*	*Mabein*	*Alam*
River	Mon	Myitnge	Myittha	Mu	Shweli	Irrawaddy
Reservoir Capacity (Ac. Ft.)	2,500,000	500,000	10,000,000	4,000,000	10,000,000	30,000,000
Initial Power (KW)	50,000	40,000	150,000	40,000	160,000	1,000,000
Ultimate Power (KW)	75,000	200,000	300,000	80,000	320,000	2,000,000
District	Minbu	Kyaukse	Lower Chindwin & Sagaing	Shwebo & Sagaing	Bhamo & Katha	Myitkyina
Land to be Irrigated (Acres)	200,000	8,000	400,000	400,000	400,000	1,000,000

O. MULTIPLE PURPOSE RESERVOIRS.

A preliminary analysis has been made of possible multiple purpose river projects as given in the above tabulation.

Of the above projects the Mon is given a high priority for reasons stated in Section XI, Hydro-electric Power. It appears to be a "natural" in a district which is already partially developed and contains a sizeable acreage of irrigable land now dry farmed.

Scheduled for near future investigation are the Myitnge, Myittha and Mu River projects. The first of these is intended as a primary source of power for the Mandalay-Myingyan Area with minor irrigation benefits. The other two projects appear to provide substantial irrigation benefits with power secondary until sizeable markets can be developed.

The last two projects listed are for long range study, being major developments where unusual construction problems will occur. However, the water supply is plentiful and vast acreages of irrigable land can be developed below each proposed dam. The power output would be secondary but a major source of income after markets are found. Substantial flood control and navigation benefits would accrue. Additional reservoir sites will be studied as time permits and the six projects listed should only be regarded as typical major selections.

P. CONCLUSIONS.

1. GENERAL. The use of water resources has been a major factor in providing high standards of living for other nations and the development of a coordinated water program is considered essential. Such a program is favored by the physical conditions, viz: ample rainfall, high altitude storage sites, and adequate construction materials. Also much irrigable land exists in a dry state for several growing months each year. With assured benefits from irrigation and large potential markets for electric power, multiple purpose projects appear to be justified, yielding incidental flood control, navigation and water supply benefits.

2. COLLECTION OF PHYSICAL DATA. Simultaneously with the planning work and prior to the design and construction of major hydraulic projects, a coordinated program to obtain physical data should be undertaken. The program would include the following:

a. Establishment of staff or recording gages on the principal rivers to obtain stream flow data. Continuous records of daily gage readings should be obtained for both wet and dry seasons. Each gage should be constructed and rated by the Hydro-electric Survey Board. It should be located where accessible to qualified gage-readers.

b. The establishment of rain gages in mountain locations where observations will be applicable to catchment areas above probable storage projects.

c. The establishment of evaporation pans in existing lakes or reservoirs to determine rates of evaporation.

d. Obtaining low water and flood water profiles of the principal streams.

e. Collection of ground water data in areas suitable for irrigation or municipal water supply.

f. Conducting silt studies by sampling rivers at all stages of flow.

g. Making spot damage estimates of each major flood in order to establish flood control benefits and priority of work.

3. FLOOD PROBLEMS. Flood problems are known to exist on the upper Irrawaddy and tributaries where irrigation projects are frequently damaged by washouts and gravel deposits. It is believed that large storage reservoirs can be constructed at moderate cost upstream from existing and proposed irrigation works in order to provide flood protection and insure ample water supply for dry years or for multiple crops. Other sites have been found that include substantial power benefits in addition to flood control and irrigation. Navigation benefits will accrue due to increased low water flow and curtailment of flood damage to shipping.

In the middle and lower Irrawaddy flood control is now provided by levees and bank protection. Undercutting is a constant threat and setback levees are constructed at danger points each year. Such expenditure could be curtailed if the flood flows of the Irrawaddy were reduced so that cutting power is eliminated. Regulation from upstream reservoirs would be beneficial and substantial. However, for the immediate future, groins are proposed by the Irrigation Department of the Ministry of Agriculture and Forests for protection of Henzada and other communities subject to caving banks, and setback levees are required for protection of less valuable areas.

Consideration should be given to sluice gates similar to the Yandoon Island project in order to build up other marshland in the lower delta area. It appears that reclamation of such land could be accomplished at moderate cost. Attendant drainage, sanitation and mosquito control work should be initiated. The formation of levee and drainage districts should be fostered, supervised by Government experts and wholly or partially financed by Government funds.

4. IRRIGATION. When cheap power is available, irrigation by pumping from the almost unlimited ground water supplies should be developed. Two pumping projects now in the planning stage are located in the Pakokku District west of the Chindwin and Irrawaddy Rivers, and the lower delta region, Irrawaddy and Pegu Divisions.

5. PUBLIC WATER SUPPLY. In many cases municipal water supply will be tied into multiple purpose projects, either by direct pipe line or by pumping from a river intake located below the dam. New water supplies should be planned at an early date for Chauk, Heho, Tavoy and Mergui. Partial systems given in the water supply tabulation should be completed, preferably with Government supervision and financing by self-liquidating loans. This program is recommended as a primary health measure.

Q. RECOMMENDATIONS.

1. It is recommended that detailed field investigation, design and construction where justified, be approved and undertaken for the following projects:

a. The Sinthe Project including a dam on the Sinthe Chaung and distribution canals to irrigate land in the vicinity of Tatkon, Yamethin Districts. This project is under detailed investigation by the Chief Engineer, Irrigation Department.

b. The Mon River Project including a major storage reservoir upstream from the Mezali Weir for combined power and irrigation releases, and distribution canals to irrigate land in the Minbu District. The project is recommended for construction in Section XI, "Power Development".

c. Lower Delta Pumped Irrigation comprising low head pumps to lift ground water onto rice land in the Irrawaddy and Pegu Divisions. This will permit double crops and crop diversification in the delta.

d. Irrawaddy Levee and Bank Protection providing groins, revetment or setback levees where undercutting occurs along the Central and Lower Irrawaddy.

2. Initiation of a coordinated program for collecting and publishing data essential to water resources planning is recommended, including rainfall and evaporation records, surface stream flow and ground water measurements, silt studies and flood damage reports.

3. It is recommended that further study be given to the following projects:

a. The Yanbe and Yin Projects to provide storage dams and distribution canals to irrigate land in the Magwe District. These projects are under preliminary investigation by the Irrigation Department.

b. The Pakokku Pumped Irrigation Project to provide moderate head pumps to boost river water from the Chindwin and Irrawaddy Rivers. This will permit a double crop on land now irrigated and new irrigation of culturable land now in dry farming.

c. The Myitnge Project to provide a storage dam at Yewa and distribution canals to irrigate new areas in the Kyaukse District. The project will provide supplementary hydro power to the Mandalay-Myingyan system.

d. The Myittha and Mu Projects to provide large storage dams and distribution canals to irrigate new areas and double crop existing irrigation projects in the Sagaing Division. Incidental hydro power will be available when the market develops.

e. The Shweli and Upper Irrawaddy Projects to provide very large storage dams and distribution canals to irrigate vast new areas of culturable land now in dry farming, and generate incidental hydro-electric power. Substantial navigation and flood control benefits are anticipated.

f. Upriver storage for existing "run of river" irrigation projects in the Mandalay, Magwe and Sagaing Divisions. Such storage will furnish needed flood protection and double crop irrigation as well as stabilizing the existing project in dry years.

g. Land reclamation and drainage work in the Lower Delta to reclaim swamp areas and eroded lands. The organization of levee and drainage districts under Government supervision appears desirable.

h. Domestic water supply to insure year round ample supply of pure, potable water to cities and towns.

i. Other water projects to provide for efficient and economic use of water resources particularly with reference to all year supply and avoidance of destructive flooding in developed areas.

Section XI

POWER DEVELOPMENT

A. GENERAL.

Throughout the world the water resources policy of any country has been a major factor in promoting economic progress and the development of a well co-ordinated water resources policy for Burma is a national necessity. To prove the soundness of the last statement it is only necessary to consider the many benefits to be derived from a sound long-term policy for the control and utilization of the water resources which would include: the improvement of waterways; irrigation; land reclamation; the generation of electric energy; the prevention of floods and soil erosion; elimination of pollution; adequate and safe water supplies and sanitation throughout the country. All of these things are necessary for the establishment of public health, comfort, safety, economic welfare and the eventual achievement of a higher standard of living. Burma is blessed by an abundant water supply. It is unfortunate that the many benefits to be derived from an adequate water resources policy has not been executed in the past.

In 1933 Mr. J. W. Mears, who conducted the first Hydro-Electric survey of India, placed Burma first as having a water power potential of three million kilowatts available under full development. Mr. B. Raikes, late Electric Inspector, Government of Burma, carried out a preliminary Hydro-Electric Survey of Burma during 1920-23 and a list of the possible sites investigated is attached at the end of this section. Due to the time required for planning and construction work on a hydro-electric project, it is important that this work get under way at once. The principal item for industrial development is low cost and adequate electric power especially hydro. The many benefits to be derived from this latter source of energy are innumerable and have been mentioned in detail elsewhere. Burma needs this low cost power. If these facilities and services are left to private development or to local communities they will not be coordinated and the result would be a number of small inefficient plants. It is necessary that the Central Government establish a system of large units as near the load centers as possible and eventually connect these scattered units into a grid to improve the efficiency of the transmission lines and at the same time make power available throughout the country to the smaller communities. This transmission system would eventually extend from Rangoon to Mandalay with hydro-electric power plants feeding the grid at strategic points. Such a system is shown on a drawing at the end of the section. It is not intended that hydro-electric power would replace the present steam and diesel power but rather augment this source of power. In a well designed system both types of power are needed. The hydro power would be used to carry the base load and the steam power would supply the seasonal peak load. In this way the prime power which is available 100 per cent of the time is greatly enlarged and the use of higher cost thermal power is kept to a minimum.

B. EXISTING POWER INSTALLATIONS.

1. HYDRO-ELECTRIC POWER PLANTS. The total installed hydro power in Burma before the war was in 10 projects totaling 17,072 KW., ranging from 30 KW. to 10,000 KW. maximum. Much of this power was destroyed during the period of occupation and no record as to present conditions is available. Details of the projects referred to above are given in the Table on the following page.

2. STEAM POWER PLANTS: RANGOON AREA. The generating plant at Rangoon consists of 2—10,000 kva turbo-generators, and 1—6,000 kva machine, making a total of 26,000 kva. For steam to the larger units there are 3—60,000 lb. per hour boilers, and a fourth boiler of similar capacity is now being erected.

City distribution is at 6,000 volts. The area served is

HYDRO-ELECTRIC DEVELOPED SITES 1938

Name of Company or Authority Operating	*District and Location*	*Name of Stream*	*Gross-Head Utilized Feet*	*Installed Power KW*	*Date of Original Installation*
A. B. Tin Co.	Heinda / Tavoy	Heinda / Chaung	—	256	1934
— DO —	Paungdaw / Tavoy	Paungdaw / Chaung	1,400	3,000	1939
Kanbank Mines	Kanbank / Tavoy	Rain / Catchment	2,085	400	1927
B. C. Ltd.	N.S.S. Mansam Falls	Namyao / Chaung	250	10,000	1920
— DO —	N.S.S. / Konny-Aung	— DO —	150	2,000	1933
Hsipaw State	N.S.S. / Sakan-Tha	— DO —	45	36	1927
Tawngpeng State	N.S.S. / Namh-San	Namhsan / Chaung	97	30	1937
Mawchi Mihes Ltd.	Karenni / Mawchi	Kamapya / Chaung	230	150	1936
Ruby Mines Ltd.	Mogok / Katha	Yeni Chaung	230	420	1898
Maymyo Electric Supply Company	Mandalay / Wetwun	Gelaung / Chaung	720	450	1933
		TOTAL		17,072 KW	

about 15 miles maximum radius from the Power plant. Power is not taken across the river. Present power load varies from 3,000 KW to 9,800 KW. Power output is about 120,000 kilowatt hours (KWH) per day for a population of approximately 600,000, or 0.2 KWH per day per person. Operating cost is around 3 to 4 annas per KWH and revenue varies from 4 to 8 annas. Fuel cost is 1.1 to 1.3 annas per KWH.

Boilers are convertible from coal to fuel oil or vice-versa in one week. At present, two of the large (60,000 lb. steam per hour) boilers are in commission for coal, and one for fuel oil. The cost balance between coal and fuel oil is close at present. Bengal slack is used. Plus 1½ inch coal goes to the railways for locomotive fuel, minus 1½ inch to the power plant. The steam plant uses 1,500 to 2,000 tons per month. Storage is about 3 to 4 months' supply. Cost of coal delivered at the plant is now Rs. 87/9 based on contract dated October, 1951. Freight costs on coal from India are currently Rs. 35 per ton. It is carried in 5,000 to 6,000 ton ships. Typical analysis of coal is M 6.0, V 24.0, FC 54.0, A 18.0, Btu 11,680. Although all this coal comes from Bengal, coal from different mines ranges from 14 to 30 volatile, and 16 to 20 ash. Coal is carried in baskets by coolies to the hoppers, crushed to ½ inch, and fed through hoppers to travelling chain stokers. It burns with a short flame. Ashes contain some charred, unburned coal. The ash clinkers slightly. Duty per KWH is *1.6 to 1.7 lbs. of coal.*

Oil used for fuel is 18,800 Btu., spec. grav. 0.93, flash point 235°. It costs Rs. 160 per ton, landed at Rangoon. Burning efficiency is higher for oil than for coal, and cost of handling fuel is less, so that oil at Rs. 160 is about equivalent to coal at Rs. 90 per ton. Oil-Coal ratio 2:3.

The power plant has been built entirely since the war, the former plant having been practically destroyed. Power load is now about equal to that of 1941. Based on present growth the annual increment of demand is estimated at between *ten and twenty per cent per year.* It is believed that with *peace restored, the demand would double in 5 years.*

Wage scales: Unskilled laborers receive from Rs. 77/4 to Rs. 85/0 per month, plus Rs. 7/8 housing allowance. Skilled labor up to gang foremen, get from Rs. 88 up to Rs. 154 plus Rs. 7/8 housing allowance.

This is the only large steam power plant in Burma. Mandalay has a diesel plant, and is erecting two 550 kva steam plants to burn fuel oil. Other power plants over the country are either diesel driven or small hydro-electric plants for towns and mines.

A record of the kilowatt hours used in the Rangoon, Insein, and Mingaladon areas during recent years is shown in the following table.

ELECTRICITY CONSUMPTION, RANGOON, INSEIN, MINGALADON AREAS
(thousands of kilowatt-hours)

Period	*Total*	*Private Consumers*	*Private Consumers Small Shops*	*Industrial Establishments*	*Institutions*
1946 (a)	2,105				
1947	6,306				
1948	11,367				
1949	13,245				
1950	19,716	7,100	2,918	5,614	4,084
1951					
J	1,931	690	280	543	418
F	1,825	642	266	528	388
M	2,178	652	293	771	462
A	2,335	765	345	715	411
M	2,357	773	340	715	529
J	2,277	790	358	653	476

(a) Only since April.

Source: Rangoon Electric Tramway and Supply Company.

This table shows a total of 11,367,000 KWH for 1948, 13,245,000 KWH for 1949, 19,716,000 for 1950, and for the first six months of 1951 a total of 12,903,000 KWH. The records include the total power of private, industrial and Government institutions. Recent records for the whole country are not available.

All of the above information regarding the Rangoon Power Plant was obtained from the Rangoon Electric Tramway & Supply Co., Ltd., operated by J. W. Darwood & Co., Ltd., H T. Moody, Chief Engineer.

3. VOLTAGE OF ELECTRIC INSTALLATIONS. Voltage as recorded by the Burma Reconstruction Department, as shown on a print dated 19 June, 1943, signed by T. D. Boldy, shows the following for voltages, phase, type of current, etc.

Location	*Volts*	*Cycles*	*Current*	*Phase*	*Wires*
Manily	220		D.C.		2
Rangoon, Insein, Syriam, Maymyo, Pakkoku, Akyab, Moulmein, Yenangyaung, and Meiktila	230/400	50	A.C.	3	4
Mogok	220	50	A.C.	2	
Namnsan	230	50	A.C.	1	
Prome, Henzada, Myaungmya, Wakema, and Taunggyi	220/440		D.C.		3
Mandalay	250/550		D.C.		3
Future Standard Voltage for all Public Supply Co.'s.	230/440	50	A.C.	3	4

From the above table it is readily seen that prior to the year 1943 no attempt had been made to standardize the electrical industry. Standardization is of vital importance and as shown by the last item in the table this work is being projected in a systematic manner, which is very commendable. A word might be written about the standard adopted. This is the British standard and it is also normal for most of Europe. It is not the standard used in the United States; therefore, tenders for items of electrical equipment and appliances advertised in the United States will be at a slight disadvantage when competing with European Companies. The low voltage standard in the U.S.A. is 110/220 volts, 60 cycle, A.C. current, 3 phase, 4 wire system.

C. POWER DEMAND AFTER REHABILITATION.

1. PRESENT INSTALLATIONS. Present installations for the whole of Burma (1939) and future electric power needs are shown in the table at the end of this section. This record was prepared by U Maung Aye, Engineer, Chief of the Hydro-Electric Survey Board. The present installation refers to prewar records. A large number of these plants were destroyed during the war, but are now being replaced as the area becomes secure. Therefore, this record may be used as the installed capacity after rehabilitation. The prediction of future needs listed in this table is entirely that of the Survey Board. The table shows a maximum demand of 208,287 KW. This is made up of 120,672 KW for the assumed industrial maximum demand and 87,615 KW assumed maximum demand for domestic and minor industries. The latter figure is based on an annual consumption of 30 KWH per person in urban districts, and 5 KWH per person in rural districts. The assumed load factor used was 16 per cent. This estimate seems reasonable for present conditions.

2. GROWTH OF POWER DEMAND WITH NATIONAL DEVELOPMENT PROGRAM. It has been stated that the present growth based on past experience is between 10 per cent and 20 per cent per year. Should the economic program recommended in this report be put into effect the present growth would soon be greatly exceeded.

Following is a list of possible new uses that may be considered and their probable requirements:

INDUSTRIAL	*KW*
1. Improvement of Rice Mill facilities	40,000
2. Fishing	1,500
3. Salt	1,000
4. Bamboo Pulp and Paper	nil
5. Re-rolling mill for scrap	5,000
6. Brick and roof tile	1,000
7. Groundnut Oil Extraction	1,500
8. Rubber	2,500
9. Cement	4,000
10. Glass—Flat and Shaped	3,000
11. Cigarettes	700
12. Ceramics	700
13. Soap	1,500
14. Sugar Mills—Raw and Refined	2,000
15. Mills for Structural Lumber and Millwork	1,200
16. Caustic Soda and Chlorine	1,500
17. Sulphuric Acid	
18. Bottling	500
19. Food Processing	1,000
20. Jute Bags	1,200
21. Fertilizer	25,000
22. Other Plants, Miscell.	30,000
23. 500,000 Acres Pumped Irrigation (Pakokku Area)	75,000
24. 4,000,000 Acres Pumped Irrigation (Delta Area)	100,000
Sub Total	299,800 KW
NON INDUSTRIAL	
25. Increase of 100 KWH per year in Urban Consumption	28,500
26. Increase of 25 KWH per year in Rural Consumption	45,500
Grand Total	373,800 KW

The kilowatts as shown above required for the expansion of industry are approximate only and are not intended to be a complete compilation, but the table gives a good indication of the probable uses that would be made of the low cost hydro-electric power when made available.

D. HYDRO-ELECTRIC POWER SITES.

1. GENERAL. Studies are being carried forward on six hydro-electric projects that appear to have the highest merit based on available information. The selection of these sites is based on a careful examination of market

location, topography, water supplies and other physical conditions. The Irrawaddy River, central and northern reaches, has been eliminated from the present studies in view of the fact that to dam such a river would be a major and costly undertaking, requiring large power markets and other downstream benefits to justify the enormous investment. The Salween River was eliminated for similar reasons, though presenting vast possibilities for economical development in the future if a sizeable market can be found.

In the northern Irrawaddy and Chindwin valleys many large tributaries are located, possessing power and irrigation potentialities. Several important multi-purpose projects are discussed in Section X, and recommended for early investigation. None are suitable for immediate power development due to their remoteness from sizeable markets.

The Sittang River is situated in a broad fertile valley having no dam sites and little power drop. East of the Sittang are two paralleling rivers with high sources and well sustained flow, the Bilin and the Yunzalin. Both possess power resources but are far from markets and are located in insurgent territory.

2. SELECTION OF HYDRO-ELECTRIC POWER SITES. There is a table entitled "Water Power Sites Investigated" at the end of this section giving all the hydro sites recommended by Mr. B. Raikes as determined during his four years of survey. The report on these sites both by Mr. Raikes and recent reports by members of the Hydro-Electric Survey Board have been studied and those sites, six in all, that had the best qualities near to centers of population and industry were selected for the first development program. Rangoon and vicinity claim first attention. Mr. Raikes discusses the Yunzalin Diversion Scheme and states that "The project has possibilities both as a power and a water-supply source but its distance away, some 125 miles, from Rangoon and the costly nature of the hydraulic works required to develop it will necessitate a very careful examination of all the factors to ensure a successful undertaking". This site has been recommended for survey and study in a long-range program. Regarding the Bawgata, Mr. Raikes states that this project is probably of little value by itself but might be considered in connection with a storage scheme on the Yunzalin. A twelve mile diversion tunnel is required, and until this tunnel is thoroughly investigated the value of this scheme cannot be determined.

a. Pegu River. The Pegu River (near Taikkyi) appears to be a more favorable site than the Bawgata Chaung for the following reasons; the Pegu site is more accessible than the Bawgata Chaung site which is located in hilly terrain where the access road would be difficult and expensive to build. The Pegu transmission line to Rangoon would be 74 miles long and almost entirely in open terrain as compared to a length of 125 miles for the Bawgata Chaung transmission line. Surveys at the Pegu site could start without delay. The Pegu project is planned to furnish low cost hydro power to Rangoon, Insein area including the delta pumped irrigation.

b. Nam Tu River. An important center of population and industry is the Myingyan-Mandalay-Maymyo district. For this district two principal sites were investigated. First the Nam Tu site which is the closest to Mandalay. This site (at the Pyaung Shoo Rapids) as described by Raikes is in a gorge over 1,000 feet deep, and is somewhat inaccessible. There is no suitable location for the powerhouse and a 2,800 foot tunnel would be required through fissured limestone. This tunnel would require lining which would be very expensive. A large amount of exploratory drilling would also be required. Although this site has a large drainage area with a minimum flow of 3,800 cusecs, it is also subject to large floods during the monsoon season. There is no storage at the site and the maximum head is stated to be 100 feet. This site has been recommended in the first six projects but it is placed in the second group as the site on the Mon is considered better suited for immediate development. When surveys and aerial photographs are available it is probable that a different solution to the problem may be worked out from that visualized by Mr. Raikes.

c. Mon River. Mr. Raikes did not examine the Mon River. However, he states that storage sites probably existed above the canal headworks at Mezali which might serve for irrigation as well as for power. He stated that discharge readings were regularly recorded by the Canal Department and are in the order of 400 cusecs during the dry season. Based on the above information, this river has been studied and an excellent storage site for both power and irrigation has been located. The site lies in a loop of the river which will permit the spillway to be located across the base of the loop away from the dam and powerhouse. From a study of the maps available no difficulties have been seen for development at this site. It is easy of access and lies close to Magwe-Chauk area and the oil fields, and is not too distant from the Mandalay area where the transmission lines will extend. This site will furnish 50,000 KW of prime power and will furnish 1,200,000 acre feet of water for irrigation during the dry season. No difficulties are known that would prevent the work starting at once on this site.

d. Saingdin River. The Saingdin River project would furnish low cost power to Akyab and vicinity and to a proposed industrial plant to be located near the site. The design for this project is further advanced than any other, due to the availability of excellent aerial photographs. Aerial photography has been requested for all of the projects mentioned herein and until this information is received little progress can be made on selecting

the dam site and completing preliminary plans and estimates. The plan of structures for the Saingdin site has been completed and is attached at the end of this section. Details of the project are given in Table I. The plan shows the location of the dam, powerhouse, and spillway. The elevation of the pool, crest of the spillway and height of the dam have been fixed, and the volume area curves computed. When preliminary figures for turbines, generators, transformers, etc., have been received, very reliable estimates can be made. Preliminary computations show that at least 14,200 KW would be available as prime power at this site during the six months of dry season and 33,000 KW would be available during the six months of wet season. The transmission distance to Akyab would be about 65 miles. No access road would be required as the river has tidal flow to the site and is navigable.

e. Lampha Chaung. The Tenasserim coastal rivers have been examined and found to contain worthwhile high head sites. One located nearest to Moulmein and selected for immediate detailed study is the Lampha Chaung with 24 sq. miles catchment, 200 inch average rainfall, and a power drop of some 1,800 feet. This promises low cost power with a 55 mile transmission line to the market. In addition to low cost power for the Moulmein area this project is to furnish power to the logging industry in the vicinity.

f. Loikaw Site. On the Salween tributaries in the Shan and Kayah States the flow is well sustained and power is large due to the precipitous drop where each tributary enters the deeply eroded gorge of the Salween. Two of the best prospective sites are located on the Balu Chaung below Loikaw and the Nam Pang below the Taunggyi-Kentung highway. Of these the former was chosen for immediate detailed study in view of its relative proximity to the central valley power markets and its natural regulation by Inle Lake, 60 miles above the site. Numerous other power sites exist in the Shan States which may prove worthy of detailed study and development.

A field inspection was made of the Balu Chaung power sites near Loikaw.

The falls located about 20 miles below Loikaw were found to be too remote for supply of construction materials and power generating machinery for economic development at this time. The falls were spectacular, in two branches, and estimated to be about 600 feet in concentrated cascades. The maps of this area show a considerable drop in elevation below the 600 foot falls and either another falls or cascades must exist. These second falls or cascades were reported but not viewed.

About halfway between these high falls and the town of Loikaw is another falls of about 75 feet. These falls are readily accessible and can be developed at lower initial cost than the other sites. A low dam at the head of the falls would back the pool up to Loikaw and make available a gross head of about 225 feet at a site about 3 miles below the dam. The present flow, first part of January, was measured to be about 1,500 cusecs. Local inhabitants estimated the low flow to be about one-third of the present flow or 500 cusecs.

Preliminary estimates indicate that approximately 80,000 to 100,000 KW would be developed at the sites discussed above and that this is one of the major power sites for all of Burma. This site lies about 75 miles to the east and near the center of a power line that will eventually connect Rangoon with Mandalay, passing through the Sittang valley. Development should start at the upper falls for local needs of the Kayah State. Therefore hydrographic surveys and rainfall stations should be established without delay.

g. Other Projects. Other projects recommended for investigation and study in a long range program include the Bawgata, the Loikaw 600 foot falls, Myittha River, the Shweli and the Irrawaddy River in the vicinity of Myitkyina. The last three have important irrigation benefits as discussed in Section X.

E. TRANSMISSION SYSTEM.

The ultimate transmission system for electric energy throughout Burma would consist of a grid interconnecting the principal cities as shown on the map at the end of this section. The main grid transmission should be 132 KV or greater. These lines should be of steel tower construction. Short, isolated lines could be 66 KV or less. Reinforced concrete will probably be more economical than steel for the low voltage pole lines.

Transmission distances from the power sites to the nearest load centers and the approximate cost of the transmission lines are as follows:

Project:	*Load Center*	*Distance Miles*	*Approximate Cost*
Pegu	Rangoon-Insein	74	Rs. 71,00,000
Saingdin	Akyab	65	61,50,000
Mon	Chauk-Magwe	132	1,25,00,000
Nam Tu	Mandalay, etc.	105	99,00,000
Lampha	Moulmein	55	52,00,000
Loikaw	Taunggyi-Loikaw-Mawchi	140	1,32,00,000
Grid	Rangoon to Mandalay	356	3,36,00,000

As increased power is furnished to the many load centers there will be a need for extending and remodeling the distribution systems. These should be planned with a view for expected loads five to ten years in the future.

Consideration should be given to layouts that will permit greater future expansion without undue duplication and accompanying excess costs. Accordingly it is recommended that detail studies be given to standards for various types of urban and rural distribution to accomplish these ends.

F. ESTIMATES OF COST.

1. HYDRO POWER. It has been impossible to make detailed estimates of cost for these six projects due to the inaccessibility of the sites and the lack of surveys and aerial photographs.

Projects that are recommended for immediate development are the Pegu, Saingdin, and the Mon. Their approximate *initial* costs for construction and transmission to the nearest load center plus an allowance for distribution costs are given in the following table:

Millions of Rupees

Project	*Construction*	*Transmission*	*Total*	*Local*	*Abroad*
Pegu	60.0	8.0	68.0	50.0	18.0
Saingdin	74.0	8.0	82.0	60.3	21.7
Mon	107.0	13.0	120.0	88.2	31.8
Totals	241.0	29.0	270.0	198.5	71.5
Allowance for distribution costs			30.0	15.0	15.0
Grand Total			300.0	213.5	86.5

Projects for near future development are the Nam Tu, Lampha, and Loikaw Upper Falls. Their approximate *initial* costs for construction and transmission to the nearest load center, plus an allowance for distribution costs are given in the following table:

Millions of Rupees

Project	*Construction*	*Transmission*	*Total*	*Local*	*Abroad*
Nam Tu	89.0	11.0	100.0	78.0	22.0
Lampha	11.0	4.5	15.5	11.1	3.4
Loikaw (Upper Falls)	30.0	14.5	44.5	35.7	9.8
Totals	130.0	30.0	160.0	124.8	35.2
Allowance for distributions costs			40.0	20.0	20.0
Grand Total			200.0	144.8	55.2

Additional costs which may be desirable in the distant future to complete the above six projects to their ultimate capacity for long-range program would be about Rs. 20,00,00,000. A large percentage of this would be for foreign exchange as it is mostly for equipment and machines.

Additional projects which may be desirable to complete a long-range program upon which no studies have been made as to costs include Bawgata, the Loikaw 600 foot falls, Myittha River, the Shweli, and the Irrawaddy River in the vicinity of Myitkyina.

2. STEAM POWER COMPARED WITH HYDRO POWER. Reference is made to Section VI, Mineral Industry, paragraphs F & G, for the possibilities of coal development and a steam power plant for the proposed Myingyan industrial area. It is shown therein that coal may be produced and delivered for about Rs. 40/- per ton. The quality of the coal is such that about 1.5 lbs per KWH will be required.

Following is an estimate of the cost per KWH for steam electric energy at various load factors. A 20,000 KW typical steam plant installation with an installation cost of Rs. 950 or $200.00 per KW is assumed.

Cost in Annas per KWH

Load Factors		20%	40%	60%	80%
Interest	4.5%				
Amort. 20 years	3.2%	.87	.44	.29	.22
Depreciation	2.3%				
Total	10.0%				
Operation and Maintenance		.33	.20	.15	.13
Fuel		.43	.43	.43	.43
Total (Annas per KWH)		1.63	1.07	.87	.78

For comparative purposes there is estimated below the cost per KWH for hydro-electric energy at corresponding load factors.

A typical 20,000 KW Hydro-Plant is assumed with cost of installation of Rs. 2360 or $500 per KW, which preliminary studies indicate to be an adequate unit cost.

Cost in Annas per KWH

Load Factors		20%	40%	60%	80%
Interest	4.5%				
Amort. (½-50 y, ½-25 y)	1.4%	1.52	.77	.51	.38
Depreciation	1.1%				
Total	7.0%				
Operation and Maintenance		.17	.10	.08	.07
Total (Annas per KWH)		1.69	.87	.59	.45

From the above analysis it can be seen that the hydro power, if available at the assumed cost, will be more economical than steam power for all but the lowest load factors. Accordingly, the proper role for steam power will be to take the seasonal peak loads and for hydro power to take the base loads. Further study will be given to the best combined use of steam and hydro power, and definite comparisons will be made for each area and power market.

G. DETAILS OF HYDRO-ELECTRIC POWER PROJECTS.

There is in preparation a detailed study of each project recommended. These studies are continuing as information is made available. At the present time computations have progressed to a more complete stage on the Saingdin project than any other due to the excellent aerial photographs that were available of this site. The details of this project are listed in the following table. All of the projects will be presented in detail in the final report. Details of the Mon Project are also listed.

TABLE I

Load Center Project Name		Akyab Saingdin	Magwe-Chauk-Mandalay Mon
	Units		
Drainage Area	Sq. Miles	354	1,880
Annual Rainfall	Inches	156	76
Annual Runoff	Percent	50	40
Annual Runoff	Acre Ft.	1,470,000	3,050,000
Volume Reservoir	Acre Ft.	1,110,000	4,000,000
Volume Drawdown storage	Acre Ft.	500,000	1,500,000

TABLE I (*Continued*)

Load Center Project Name		Akyab Saingdin	Magwe-Chauk Mandalay Mon
	Units		
Avg. Low Flow (6 mo. storage)	C.F.S.	1,300	3,920
Avg. Low Flow Natural	C.F.S.	—	170
Avg. Low Flow Nat'l & storage	C.F.S.	1,300	4,090
Max. Head	F.T.	190	210
Avg. Drawdown Head	F.T.	164	179.5
6 Mo. Avg. Power (Low Flow)	KW	14,200	49,000
6 Mo. Avg. Power (Rainy Season)	KW	33,000	53,000
Initial Installation	KW	40,000	50,000
Flood Discharge (Recorded)	C.F.S.	—	317,000
Initial Cost Plant	Rs.	7,55,50,000	10,61,00,000
Initial Cost Transmission	Rs.	61,50,000	1,24,00,000
Total Initial Cost	Rs.	8,17,00,000	11,85,00,000
Transmission distance	Miles	65	132
Annual Initial Cost	Rs.	65,50,000	95,00,000
Annual Initial Power at load center	KWH	172,000,000	236,000,000
Load factor	Percent	52	60
Initial Cost per KWH at load center	Annas	0.61	0.64

H. BIBLIOGRAPHY.

Information contained in the Power section of the report has been based on a study of previous reports listed in the bibliography and on additional data in the form of maps, records, etc., furnished by the Hydro-Electric Survey Board.

REPORTS

1. Extracts from Hydro-Electric Survey of India, Vol. III. Preliminary Forecast of the Water Power Resources of India 1919-1921—By J. W. Meares.
2. The Yunzalin Diversion Hydro-Electric Project—By B. Raikes, 1923.
3. The Hydro-Electric Survey of Burma (1920-23). By Mr. B. Raikes, 1924.
4. Annual Report on the Administration of the Electricity Act in Burma. December 1939.
5. Paper on the Water Resources of Burma. By I. Walker, 1947.
6. Recent Reports by the Hydro-Electric Survey Board.
   a. The Namhpak Hka near Sinlum, 1948.
   b. The Bawgata Chaung with diversion from Pyagawpu and Yunzalin, August, 1947.
   c. Preliminary Reconnaissance of the Bawgata River, December, 1947.
   d. Bawgata Project 1948-1949.
   e. Preliminary Reconnaissance of the Saingdin Falls, April, 1948.
   f. Selected Water Sites, November, 1949.
   g. List of Possible Hydro-Electric Sites—1949.
   h. Preliminary Reconnaissance of the Namhpak Hka Chaung.

EXPLANATORY NOTES

To: *Table — "Present Installations (1939) and Future Electric Power Needs".*

Columns 1 and 6.

Total area of Burma is 261,610 Sq. Miles and population 16,823,800 (1941 Census). In these Columns, the following remote regions have been omitted as being outside the range of economic supply:- Hukong Valley, Naga Hills, Chin Hills, Sumpra Bum Area, the Triangle, Arakan Hill Tract, Wa State and Salween District.

Column 7.

In calculating density per sq. mile, the whole District area has been taken and no deduction made for areas under forest. Total Forest Area of Burma is 145,000 Sq. Miles.

*Column 9.**

Excluding Bulk Supply from B.O.C. refinery for Syriam public supply.

Column 10 includes:—

Hydro-Electric Plants (Mostly for Mining Industry)....	17,000 K.W.
Hydro-Electric Auxiliary Diesel or Thermal.....	3,750 K.W.
Steam Plants in Oil Industry fired by natural gas or oil residue	32,500 K.W.
Steam Plants in Saw Mills fired by Wood refuse.....	3,000 K.W.
Steam Plant Burma Railways, Myitnge, 1,150 K.W. and Starch Factory, Rangoon 400 K.W.....	1,550 K.W.
The balance of about 1,000 K.W. are mostly small lighting plants in Rice Mills where steam is generated from Paddy Husk.	

Column 11.

Prewar there were 2,860 steam plants, some 700 of which were rice mills, and the size of plant varied up to 1,500 H.P. In this estimate, an average of 75 H.P. has been assumed and the actual output, allowing for standby, etc., at 50% or 40 H.P. for each plant.

It is foreseen that the demand shown in this column may not materialize as the industries may prefer to continue generating their own motive power by steam from paddy husk, wood refuse, etc. In the event of this being so, the power included in this column is intended to meet the demand of new industries, for which no provision is made in the estimate.

The requirements of Agriculture for irrigation, land reclamation and improvement (Probable demand 28,000 K.W.) and electrification of Railways (probable demand 65,000 K.W.) are also not included in this estimate.

Column 13 and 14.

At 16% load factor.

(Signed)
(MAUNG AYE)
Hydro-Electric Survey Engineer.
Hydro-Electric Survey Board.

Section XII

ORGANIZATION FOR PLANNING AND EXECUTION OF ECONOMIC DEVELOPMENT

A. GOVERNMENT ROLE IN PLANNING.

Wherever there is the exercise of the function of government, there is some degree of planning. The very essence of governing is predicated on establishing orderly relationships among people, and providing mechanisms and instruments whereby individuals can live and work together. To function effectively, government must relate its activities to the realities of the country's environment and to the requirements of its people.

All this inherently necessitates planning, a role which is just as inevitably a part of government as is the policing or the military or the taxing function. Whether it be in the determination of traffic regulations, the providing of public education, the establishment of standard weights and measures, or the complex control of the monetary mechanism, governments do plan. The issue is not whether there be government planning but, rather, what the degree of planning by government should be and how the planning function can be performed most effectively.

The degree to which government engages in planning, or the areas over which planning is exercised, depends on the extent of control by government. Obviously in a society in which totalitarian concepts prevail, government planning will extend into practically every facet of human behavior and human relationships, because the government extends its control so completely. But even where maximum individual freedom is the established policy of a country, control and therefore planning is needed in some measure. In fact, maximum freedom for all the people necessitates restraints on each individual so that he may not interfere with the freedom of his fellow man. Only government can be the source of the many basic controls or aids or restraints which make for orderly and productive life.

In the economic area, the degree of planning by government depends on the ideology of the country, the state of development of the economy and the objectives sought. If widespread government ownership and operation of productive enterprises is to prevail, the scope of government planning will extend far beyond what would be needed in a largely free enterprise economy. Where there is a determined purpose to accelerate the economic development of a country, government planning will be more extensive than in a country where there is no central drive for material progress.

It is clearly not within the purpose or scope of this report to suggest the nature or character of the political, social or economic organization of Burma. However, it may be said that as an absolute minimum, any modern government must plan in such fields as fiscal policy, taxation, money, credit and banking, international trade policy and labor relations policy. It is clear that Burma, if she wishes to carry through a major economic development program, will have to go beyond this bare minimum. How much further she chooses to go is for Burma to decide. Underlying this survey is the basic assumption that Burma wishes to accelerate her economic development. The fulfillment of this objective will require a positive role by the Government of the Union of Burma in planning such development. There must be effective governmental organization for planning if this role is to be competently performed. There must likewise be effective organization for implementation if the plans are to be translated into results.

B. GOVERNMENT ORGANIZATIONS FOR PLANNING.

Increasingly, it has been recognized and accepted that there must be some central entity within government which has the responsibility for establishing an over-all program for most effectively utilizing the resources of a country, relative to some pre-determined objectives.

Burma has already recognized the importance of the national planning function by establishing a Ministry of National Planning and an Economic Council.

1. THE MINISTRY OF NATIONAL PLANNING.

a. Role of the Ministry. Final responsibility for the preparation and continuous improvement of an overall and comprehensive program of economic development must of necessity be delegated to one agency of government. The Ministry of National Planning has appropriately been entrusted with this task. The importance of the Ministry as the focal point of all economic planning in the government must be firmly maintained. The retention of the National Planning portfolio by the Prime Minister is indicative of the significance which is attached to this Ministry by the present government. It is appropriate that this situation be continued at least until a comprehensive program for the country's economic development has been widely accepted and its implementation is well under way.

The vesting of final responsibility for the planning of economic development in the Ministry of National Planning must not be interpreted to mean that all planning should be done within the Ministry. Such a conception would result in making the entire planning process an ineffectual one. Each Ministry and Board and each of their departments and sub-divisions must concern itself with planning in the area of its own authority. In fact, each of these must clearly be assigned the initial responsibility in its own area of competence for preparing plans and programs designed to utilize the resources of the country more fully and more efficiently for the benefit of all the people.

To assist the other agencies of government in fulfilling this role, the Ministry of National Planning should serve them in two major ways. First, it must provide them with the overall goals which comprise the general framework of the development program. These goals will take into account the productive resources of Burma on the one hand, and the wants of the Burmese people on the other. The various Ministries and Boards will prepare specific policy and project plans within this general frame of reference. Second, the Planning Ministry must coordinate the recommendations of the various government departments to ensure that the individual projects add up to the overall goals, that the policies will serve to help achieve the objectives, and that the total development program is internally consistent and well balanced. These two functions are closely inter-related.

The relationship between the Ministry of National Planning and the rest of the government must be continuous and intimate. It must go far beyond the mere interchange of memoranda and reports. In setting realistic goals for economic development, the Ministry of National Planning requires the full benefit of the judgment, knowledge and experience of experts in all branches of government, and not just statistical and technical reports. Similarly, the recommendations concerning specific policies and projects prepared throughout the government will be on a sound basis if the several agencies are familiar with the thinking of the Planning Ministry's staff. There must be a constant two-way flow of ideas and information and the minimum of duplication of effort. Close cooperation can be facilitated by keeping the staff of the Planning Ministry down to a small core of outstandingly capable individuals.

Particular comment is necessary on the tie-in between the planning and budgetary functions. Obviously, plans which require governmental financing will come to nought unless financial provision is made for them in the budget. Similarly, if the budget provides for development financing which is unrelated to a sound and comprehensive program, a serious lack of balance and waste of resources will result. In addition to providing the funds necessary to specific development plans and projects, the budget should also be in accord with the broad fiscal policies called for by the overall program.

Once a development program has been adopted, the budget of the government must be geared to all the features of the program. This necessitates the closest possible coordination between the Ministry of Finance and Revenue and the Ministry of National Planning.

To perform the vitally important function of planning with maximum effectiveness, the Ministry of National Planning must scrupulously avoid getting involved in operations. The execution of the program is the proper responsibility of other agencies; they, and not the Planning Ministry, must carry out the projects and policies called for by the program.

b. Organization of the Ministry of National Planning. The staff of the Ministry of National Planning should be divided into four separate divisions or units, namely an Economic Research and Planning Division, a Central Statistical Office, a Project and Resource Use Division, and the Administrative Office which takes care of the housekeeping functions of the Ministry.

The Economic Research and Planning Division should be responsible for the preparation of the overall plan for the country's development on a continuing basis and for recommendations of basic policies. The creation of a staff of economic specialists is an absolute necessity, without which the Ministry of National Planning will not be able to discharge its function adequately. Such a staff should include as a minimum specialists in the following fields: national income analysis; fiscal policy; taxation; money, credit and banking; foreign trade and exchange; labor and labor relations; marketing and distribution; and cooperatives. These specialists must work in close contact with their opposite numbers in the respective Ministries,

Departments and Boards. They would prepare factual and analytic studies and recommend policies. They would perform the staff work so essential for the informed deliberations of the Economic Council.

The Central Statistical Office should be responsible for the development of primary statistics needed for intelligent planning and for the preparation of national income estimates and related data. The importance of a well-staffed, well-trained and well-equipped Central Statistical Office cannot be over-estimated.. In the absence of the basic facts, selected and processed in accordance with needs, sound planning is impossible.

The Project and Resource Use Division should be responsible for guiding and coordinating the work of the several agencies in the preparation of projects, for evaluating specific projects in relation to each other, and for translating specific project plans into requirements for materials, facilities and manpower. This Division would require a small staff of experts, including specialists in the fields of agriculture, forestry, mining, industry, transportation, power, construction and manpower.

2. *The Economic Council.* The Economic Council should serve as a body of top policy leaders of proven ability and great responsibility who recommend plans in the economic area to the Government through the Ministry of National Planning. This Council should pass upon the recommendations and plans of the Ministry of National Planning, as well as propose plans and policies for study and recommendation by the Ministry of National Planning.

In addition to its role in planning, the Council should be responsible for continuous review of the progress of the economic development program. Government departments and public bodies should be required to report progress in their areas of responsibility at quarterly intervals to the Council. An overall quarterly report on economic activity should be issued by the Council, including a critical appraisal of the progress of the development program. This analysis and reporting of progress should not be confused with the task of expediting, which is an administrative responsibility not appropriate for the Council.

The Ministry of National Planning should perform the staff functions for the Economic Council in the area of planning. It is recommended that there be a small progress-reporting staff directly attached to the Council plus the Secretariat essential for its administrative needs.

The composition of the Economic Council should be limited in size, but must be sufficiently large to ensure the participation of those who bear the largest responsibilities in carrying out the economic policies and programs of the government. It would appear desirable to have as members of the Economic Council those Ministers whose functions are inherently related to the basic economic activities of the Government, especially the Minister of Finance and Revenue, the Minister of Agriculture and Forests, the Minister of Commerce, the Minister of Industry and Mines, and the Minister of Cooperation and Commodity Distribution, as well as the Minister of National Planning. Similarly, the head of the Union Bank should be a member of the Council. If an Industrial Development Board and a Mining Development Board are established, inclusion of their representatives must be considered.

Additions to membership on the Economic Council from the ranks of the legislative branch of the Government or of individuals with outstanding ability from the private community call for serious consideration. The inclusion of personnel from other than the executive branch of the Government is doubtful.. The Economic Council must deal with matters of the utmost importance in an environment of greatest confidence and fullest frankness of expression. Inclusion of representatives from outside the Government or even from the legislative branch might from time to time serve to restrain discussion or limit the consideration of confidential or secret information.

The benefit of participation of persons from outside the executive branch can be valuable, but it can be best obtained through advisory bodies. Also, experts and leaders who are particularly well versed in the subject matter under consideration should be invited to meetings. The Economic Council might attach to itself a Public Advisory Committee on which leading members of the community can participate, as well as a Legislative Advisory Committee. Such Committees, however, will be effective only if there is careful and highly competent staff work performed for them.

It is suggested that the Economic Council be called upon to consider only plans and policies of basic importance. The Council should not concern itself with each day-to-day economic issue which faces the Government. It should in the firmest sense be a policy body advisory to the Government. The Ministry of National Planning should transmit in full the findings and recommendations of the Economic Council to the Cabinet.

It is recommended that:

a. Insofar as is practicable, the agenda of meetings of the Council should be distributed to its membership at least two or three days in advance of the meeting; and that for each agenda item, a staff memorandum be distributed which will describe the nature of the problem, set forth the pertinent facts and data, evaluate the policy issues and choices involved, and submit such recommendations as seem to be appropriate. In this connection, it is suggested that staff documents be signed by the author, and that the Staff Director's and the Secretary's review and approval also be indicated.

b. Staff members concerned with specific agenda items should be present at meetings of the Economic Council.

c. The Planning Advisor should participate in all meetings of the Economic Council.

C. GOVERNMENTAL ORGANIZATION FOR THE EXECUTION OF PROGRAMS.

The larger the participation of Government in the economy of the country, the more important it becomes that the Government organize itself so as to discharge its responsibility efficiently, and that it create appropriate, instruments to execute its policies, plans and programs. Planning without implementation is largely useless. Moreover it gives a false sense of accomplishment. Development must be both planned and carried out if there is to be maximum progress.

1. THE EXECUTIVE DEPARTMENT AS A WHOLE. A brief consideration of the several Ministries, and of the responsibilities assigned to each, suggests that thorough study might well result in recommendations for the transfer of certain responsibilities from one Ministry to another, or even in the consolidation of certain Ministries. For example, it seems that at present responsibility for certain taxes rests with the Ministry of Education; responsibility for money-lending and money lenders, with the Ministry of Agriculture and Forests; responsibility for banks (other than agricultural banks and the Union Bank of Burma), with the Ministry of Commerce and Supply. Such assignments seem anomalous in the light of currently accepted principles of public administration, and might well be reconsidered as part of a thorough-going analysis of the Executive Departments.

Similarly, it appears that a comprehensive study and appraisal of the internal structure, staffing, pay scales and operating procedures of each of the executive agencies might well result in helpful recommendations for the more efficient organization and operation of Government as a whole.

Such a study would be analagous to that recently carried out by the Hoover Commission in the United States. Before recommending so large-scale and far-reaching an undertaking, it is recommended that an expert in public administration be assigned to undertake some preliminary studies, including some spot surveys within the Executive departments and agencies, to indicate whether the broader study should be undertaken. The need for effective administration within each Ministry and Board to execute its part of the development program is obviously of primary importance.

2. THE STATE BOARDS. Serious economic responsibilities have been delegated to a number of State Boards (State Agricultural Marketing Board, Inland Water Transport Board, State Timber Board, Electricity Supply Board, Sugar Control Board, Oil Industry Board, Paper Factory and Chemical Industries Board, Tile Factory Board, Civil Supplies Board, Mineral Produce Marketing Board, Spinning and Weaving Board, etc.).

The State or Public Board is an organizational device on which the Government leans heavily to discharge the responsibilities it has undertaken in the public sector of the economy. A preliminary examination suggests that this device has developed on a "spot" or *ad hoc* basis, rather than in pursuance of a carefully thought out plan of governmental organization. In terms of function, the responsibilities assigned to Boards range from operations (buying, selling, production), to regulation, and to planning and research. Membership on the Boards is more or less governmental in character, with representation from the several Ministries and Departments, although private representation is also provided in varying degree. So far as government representation is concerned, the same officials frequently serve on several Boards. Provision is made for the Boards to maintain their own financial accounts, subject to government audit.

In terms of efficient governmental organization, the State Boards give rise to a number of serious questions, which require intensive study. It is conceivable that some of the functions they perform might be better handled in some cases by or within existing government Departments. Even in instances where it is agreed that the State Board is an appropriate instrument for executing a specific government program, a number of issues remain. The basis on which the members of the Board are to be selected is highly important. Membership on a Board by a Minister might appear to be desirable, but such membership could result in domination of the Board by the Minister. In most instances Board members, or at least their Chairman, should serve on a full time basis. Board members generally should restrict their participation to policy questions only, leaving supervision over actual operations to administrators, who are responsible to the Board as a whole. These are merely indicative of many policy considerations which arise with respect to the Board mechanism.

In view of the extremely important role played by the State Boards in the Burmese economy, and the numerous questions which require consideration, it is recommended that an intensive study be undertaken of the nature and operations of existing State Boards, so that light may be shed on some of these basic problems. Such a study should evaluate, in terms of Burma's experience with the State Boards thus far, the degree to which the organizational form of the State Board is suited to the various tasks to which the Boards have been assigned and additional tasks arising out of the development program. The study should also consider the experiences of other countries with the

State Board device, as well as the way in which the Boards can best tie in with the economic development program.

3. DEVELOPMENT CORPORATIONS. The major recommendations which this Preliminary Report has to make towards efficient government organization for the specific execution of much of the economic development program were presented in Sections VI and VII, where an Industry Development Corporation and a Mineral Development Corporation are discussed. Further study may result in recommendations for Development Corporations in other sectors of the economy. It was considered appropriate to discuss these new bodies separately in the sections dealing with Industry and Mining.

The Development Corporations, it is contemplated, will be created by statute as legal entities, clearly distinct from the several Government Departments, and each responsible to its own Board of Directors. Each will create or sponsor the creation of new and separate corporations to carry out operations autonomously within specific fields of economic activity. The Development Corporation itself and the operating entities it creates or sponsors must seek to operate on a business-like basis, in accordance with sound engineering and economic principles.

In connection with the Development Corporations, the following specific observations are offered:

a. It seems clear that the equity financing of the Development Corporations should be entirely governmental.

b. The composition of the Board of Directors is, as in the case of the various State Boards, a matter of great importance. Serious consideration and study of recent experience in this regard is required here. The role of the Chairman of the Board is vital. He should unquestionably be required to serve on a full-time basis.

c. In general, responsibility for operations should be delegated to a General Manager or Executive Officer, while the Board of Directors confines itself to decisions on policy matters. There will always be an intermediate area, however, where operations impinge on policy, and vice versa. Questions in this area might be handled by a small Executive Committee of the Board of Directors, in consultation with the General Manager.

d. Once established and initially financed by the Government, the Board of Directors should be permitted to run the Development Corporation on a business-like basis. Within the general framework of Government's policy objectives and the economic development program, the Development Corporation should be permitted to borrow money in the capital market against its own securities up to limits set in relation to its responsibilities; hire and fire personnel; decide when to lend and when to invest; determine when to assist in the expansion of existing enterprises, and when to initiate new enterprises; specify what charges, if any, to make for technical assistance and aid to autonomous enterprises; decide when to assist private industry or establish wholly-owned enterprises.

In so far as possible, criteria for the determination of questions such as the above should be defined in the enabling legislation creating the development corporations. This would provide, as it were, an "administrative blue-print" which would enable the Development Corporation upon its formation to devote its full energies to development activities.

The ECAFE Secretariat has been much interested in this general problem, and would be prepared to lend technical assistance in preparing administrative and organizational blue-prints for government-owned enterprises.

It is recommended that once the Industry Development Corporation is established, existing State Boards devoted to industrial production—such as the Tile Factory Board, the Paper Factory and Chemical Industries Board, and the Spinning and Weaving Board—be brought within the new framework, and that these Boards be reorganized and re-financed as individual corporations subsidiary to the Industrial Development Corporation.

D. MAXIMIZING THE EFFICIENCY OF PRIVATE ORGANIZATIONS.

The needs of the economic development program demand more efficient private organization as well as more efficient public organization. The government can assist greatly in developing improved efficiency in the sphere of privately organized enterprise. Examination of the forms which private production and enterprise can take will help clarify the Government actions necessary to foster their increased efficiency.

In the private sector, the single ownership form of production is generally found in small-scale agriculture; in handicrafts, home industry and small-scale production; and in trade and service occupations. It is well suited to all of these because of limited capital and labor requirements, the incentives and personal satisfaction afforded by ownership, and the importance of personal contacts with customers and markets. It may be noted that the term "cottage industries" is not mentioned above. As used in Burma, it seems to embrace three different types of production—family home production, handicrafts and small scale industry. It is important to keep these distinctions in mind, since measures designed to encourage "cottage industry" must be adapted to the particular kinds of operation involved.

The partnership form of private production is also well-suited to small scale production and to trading and service occupations, for similar reasons. It enables partners to combine in order to pool capital, experience and ability, to divide long hours of work, or to specialize in different aspects of the business, production and selling, for example.

The private corporation is a form of organization which makes possible the participation of a great many individuals in financing a productive enterprise on the basis of a limited risk for each, utilizing expert hired managerial talent. In industrialized countries, the corporate form of organization has contributed in major degree to economic development, because it has made possible widespread investment in large scale production. The corporate form is also used at times in smaller scale production where limited liability is desired by investors. When production is to be privately organized on a fairly large scale, the corporate form of organization is almost mandatory.

Cooperatives may be organized by consumers to reduce the ultimate cost of the things they buy. Less frequently, they have been organized by worker groups who seek to share the profits which may result from their efforts. In agriculture, co-operatives can be developed successfully as both consumer and producer organizations. Farm co-operatives can buy seeds, fertilizer, animals, tools and equipment for their members; they can extend credit to their members; they can process the produce of their members; and they can market their produce collectively as well. Both consumer and farm co-operatives can make an important contribution to Burma's economic welfare and development.

The Government can and should render general assistance throughout the sphere of private organization in a variety of ways. It should develop cheaper sources of fuel and power. It must provide better transportation and communication facilities. It should, through the development of Burma's natural resources and basic industries and through the beneficial relaxation of import controls and tariffs, provide cheaper raw materials, basic metals. machinery and chemicals. It can, through monetary and banking reforms and appropriate fiscal policies, foster cheaper credit and create greater mass purchasing power. It can provide research and technical assistance to help reduce production costs. It can eliminate unnecessary delays and difficulties which business men encounter in dealing with government to obtain licenses, permits, etc. It can provide standardized weights and measures. It can provide inducements to new and desirable investment by tax incentives, accelerated amortization, loans, financial participations and similar means. It can conduct training programs to develop skilled workers and technicians needed by industry. It can create an atmosphere of security and confidence which will encourage investment in enterprise.

Government must also make it clear to all those engaged in the privately organized sphere of the economy that in the first instance, responsibility for achieving greater efficiency rests with them. Private individuals and firms must make an all-out effort to modernize their equipment and production methods; to keep up with the latest techniques; to develop better labor relations; to provide worthwhile incentives to their workers; to think in terms of modest profits per unit of sales and of greater sales; to study market trends and developments; to improve their record-keeping and accounting so as to be able to analyze their costs and improve their efficiency; to develop the art of salesmanship; and to give better service to the public.

Where production is privately organized, the Government should ensure that it operates in a manner consistent with the general welfare of the country by appropriate policies with respect to minimum wages, healthful working conditions, collective bargaining, pure food and drug laws, satisfactory quality standards, truthful advertising, honest weights and measures, competitive pricing, reasonable profits, and the like. In a great many cases, Government can serve the general welfare better by playing the role of umpire, by establishing the rules under which private production may be conducted, and by fostering the development of institutions which can assist producers, than by engaging in production itself.

E. STATISTICS, ACCOUNTING AND REPORTING.

1. STATISTICS — THE EXISTING SITUATION. Well-selected comprehensive, reliable and timely statistics are an indispensable tool in the planning of economic development programs and in their execution. In their absence, needs cannot be evaluated and progress made cannot be measured.

Burma today lacks many of the data necessary to the successful planning and execution of an economic development program. Among the statistics which would have been of great assistance in the preparation of this Preliminary Report, and which were not available, are reliable and up-to-date data on: the national income and its component parts; the distribution of income by income classes; consumer expenditures and expenditure patterns; industrial production; marketing and trade; employment, unemployment and under-employment; residential and other construction; wages and hours; profits; rents; prices received and paid by cultivators; road traffic; and many others.

It is clear that the statistical activities of many of the Government's departments and agencies, and of the State Boards as well, need to be strengthened as to coverage, quality and timeliness. Existing gaps need to be filled.

2. IMPROVING BURMA'S STATISTICS. The United Nations Statistical Advisor to the Government of the Union of Burma in the Ministry of National Planning has been making a thorough and expert study of the problems involved in developing a comprehensive, reliable and timely statistical program for the Union of Burma. His findings and recommendations embrace such ques-

tions as: the development of trained statistical personnel; the execution of a Census in stages, (because of the insurrections) beginning in 1953, covering the fields of population (including labor force and cottage industries), agriculture, industry and housing; the utilization of modern machine tabulation; additional foreign technical assistance; and the development of a Central Statistical Office which would coordinate the statistical activities of the Government, raise statistical standards, see that existing statistical gaps were filled, eliminate unnecessary duplication of effort, perform central machine tabulation services, provide training facilities, and the like.

It is desired here to express general concurrence in the findings and recommendations of the Statistical Advisor, and to recommend that prompt action be taken to implement them.

3. REPORTING AND ACCOUNTING. It is a universally accepted principle of public administration in democratic countries that public bodies which have been created to serve a specific purpose should be required to report periodically on their operations and finances, and that these reports should be public in nature. This applies especially to the public or State Boards which now exist, as well as to the Development Corporations which may be created to assist in the economic development program. There is no better way to ensure the efficient and conscientious performance of their duties by such bodies than to enable the public at large to appraise their performance, criticize them if necessary, and make suggestions for their improvement.

It is urged that this principle of full public reporting and financial accounting, with audit by the Government, be established for such bodies. The periodicity of such reports may vary from three month intervals to intervals of one year. In no case, however, should the time interval be longer than one year.